

Economic Impacts of Workfare Reforms for Single Mothers: Benefit Substitution and Labour Supply Responses*

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Abstract

We analyse the economic impacts of nationwide Norwegian reforms on the state benefit programme targeting single mothers. Our results show that for each 100-NOK reduction in benefit payments from the programme, single mothers replaced 65 NOK through benefit substitution. Their labour supply and disposable income also increased in the short term. However, the reform doubled the poverty rate among single mothers in the long term. The reforms led to a total net gain to public expenditure of 3.6 billion NOK (449 million EUR) covering the 1998–2008 period, corresponding to a 14% decrease in total benefit payments to single mothers.

JEL Codes: *H53, I38, D19*

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I. Introduction

Single mothers have weak labour market attachment and exceptionally high poverty rates across countries (Brady and Burroway, 2012). Despite high female employment rates and multiple state-founded family-policy measures, this is also true for Norway: Single mothers in Norway have lower levels of education and earnings, and higher levels of poverty and welfare dependence compared with the general population (Omholt, 2016).

In an attempt to deal with the welfare dependence of single mothers, in 1998, Norway implemented a nationwide reform of the state benefit programme targeting this group, termed “transitional benefits”. The most important features of this reform were a substantial reduction in the maximum period for the receipt of transitional benefits, the introduction of work requirements for eligibility and the lowering of the maximum eligible age of the youngest child.

There are two main potential behavioural responses to the reform. On the one hand, single mothers could respond to the reform by increasing their labour market participation. On the other hand, single mothers could respond to the decrease in transitional benefits by substituting them with other various publicly funded benefit programmes, so-called benefit substitution. 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 transitional benefits with labour earnings or other benefit payments.

The degree of substitution by various types of other benefit programmes is also highly relevant for policymakers. 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. The extent of benefit substitution depends, among others, on the going wage rate for the target population, the costs of combining work with child rearing and the hassle costs of qualifying for other benefit programmes. If the non-pecuniary costs of qualifying for other benefit programmes are relatively low, then this

implies that the effective tax rate on labour earnings is high. In such a scenario, we should expect strong benefit substitution, potentially crowding out any potential reform effects on employment and labour earnings. On the other hand, if the non-pecuniary costs of qualifying for other benefit programmes are relatively high, we should expect low degrees of benefit substitution and strong reform effects on labour earnings. Policymakers should consider such trade-offs carefully before reforming targeted benefit programmes.

We analyse the economic impacts of the Norwegian reform of the transitional benefit programme for single mothers and derive the net fiscal impacts of the reform on both the affected single mothers and public expenses. Our analysis accounts for behavioural responses in terms of benefit substitution and labour supply responses. 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 the full implementation (2005–2008, i.e., long-term effects). In our main empirical specification, we apply a repeated cross-section approach. Thus, the long-term effects we identify are the long-term effects of the reform over time, not to be confused with the long-run effects of the reform on the affected individuals.

The motivation behind our main specification being a repeated cross-section approach is that the implemented reform is likely to have heterogeneous effects across the population of single mothers. In such a scenario, the population studied matters for the interpretation of the estimated effects. As we aim to capture the average treatment effect on the treated (ATT) single mothers, the most natural population to study is the entire population of single mothers. If we include individual fixed effects in the model, we only identify the reform effects for a sub-

population of single mothers who are observed both before and after the implementation of the reform. The effect of the reform on such long-term single mothers could be different from the average treatment effect for the population of single mothers.

The main drawback of our repeated cross-section approach is that it is vulnerable to compositional changes in the population of single and married mothers. Indeed, a caveat of our quasi-experimental setting is that we find evidence of such compositional changes over time. We deal with these compositional changes by reweighting the control group of married mothers to balance the distribution of covariates between single and married mothers. Also, it is reassuring that when we disregard the likely treatment effect heterogeneity and include individual fixed effects in our specification, the results are largely similar to our main results. In addition, we employ several specification checks that prove the robustness of our main findings.

Our findings show that the reform was successful in reducing the uptake and payments of transitional benefits. However, for each 100-NOK reduction in transitional benefits, the single mothers affected by the reform replaced approximately 65 NOK through benefit substitution. The affected mothers increased their uptake of paid sick leave (SI) by about 67%, rehabilitation (Rehab) benefits by about 122%, disability insurance (DI) benefits by about 54% and finally, unemployment insurance (UI) benefits by about 41%. The benefit substitution that we observe persists over the long term. Additionally, we find that in the short term, the drop in transitional benefits was more than fully compensated for by an average increase in labour earnings. We estimate that the reform increased the disposable income of single mothers in the short term. However, because the estimated increase in labour earnings diminishes over time, there is little long-term effect of the reform on the disposable income of single mothers. For some single mothers, the reform had strong negative consequences. We find that in the long term, the reform more than doubled the poverty rate among single mothers.

In terms of the net fiscal impact on public expenses, the reform has been 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 3.59 billion NOK in public expenditures.¹ This net gain corresponds to approximately a 14% decrease in overall benefit payments to single mothers in the reform period, compared to the counterfactual situation in which yearly total benefit payments in the post-reform period would have equalled the pre-reform mean for single mothers.

As welfare dependence among single mothers is a universal problem, 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 USA, the UK, Australia and the Netherlands).² 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 single mothers and decreasing the programme caseload and expenditures.³ Mogstad and Pronzato (2012) find that the Norwegian reform increased the average labour market participation and the earnings of single mothers but also led to reduced disposable income and increased poverty among a sizeable subgroup of single mothers.

However, there is scant evidence of benefit substitution and the total state expenses for 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 impacts of such reforms. To the best of our knowledge, our study is the first to analyse the overall public expenses for a reform that stimulates single mothers to work. Our data also allows

¹ At 1998 prices.

² 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.

³ See, for instance, Blank (2002) and Moffitt (2007) for an overview of the literature on a work-encouraging reform in the USA, and Eissa and Liebman (1996), Meyer and Rosenbaum (2001), Blundell *et al.* (2005) and Francesconi and van der Klaauw (2007) for in-work tax benefit reforms.

us to analyse benefit substitution by single mothers, using an exhaustive list of all possible alternative benefit programmes. Thus, to the best of our 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.

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.⁴ Relatedly, 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. However, these studies do not estimate overall state expenses, with the exception of Inderbitzin *et al.* (2016). They analyse how extended UI benefits in Austria affect early retirement through programme complementarity (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 increased costs by about 13,000 EUR per eligible worker aged 50 to 54 and by about 9,000 EUR per eligible worker aged 55 to 57.

II. Background

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.⁵ In 1998 and 1999, the Norwegian government introduced two reforms. Table 1 details their most important features.

⁴ See, for instance, Karlström *et al.* (2008), Henningsen (2008), Bloemen *et al.* (2013), Borghans *et al.* (2014) and Inderbitzin *et al.* (2016).

⁵ Single fathers in Norway may also receive transitional benefits. The reasons for excluding them from this study are that only 14% of single parents in Norway are men, and that single fathers have significantly higher labour market attachment and earnings than single mothers do (Andersen *et al.*, 2002).

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 at least 3 years old
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 new-born 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 below a threshold of 1,891 NOK (1998 prices) per month in 1998 or received SI benefits below that threshold and did not receive Rehab or DI benefits.

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.

The main reform in 1998 imposed several new restrictions: 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 reform implemented on 1 July 1999 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.

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 day-care centres. 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 V). It is reassuring that the results from this exercise are similar to the main results.

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 *et al.*'s (2016) 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 IV 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.

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, there is considerable scope

for benefit substitution between alternative benefit programmes. Relevant alternative benefit programmes include SI, medical- and work-related Rehab, DI, UI and social assistance (SA).⁶

The SI benefits compensate 100% for the loss of income for workers with a short-term illness lasting less than one year. Previously, to be entitled, employees to 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 to the SI programme in 2004 increased the number of weeks worked in order to be entitled to benefits 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 do so for medical reasons). The employer pays SI benefits for the first 16 sick days.⁷ 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. These benefits are provided while the individuals undergo treatment to improve their ability to work and may be received for several years.⁸ 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 restrict the inflow of DI benefits, the state tightened the eligibility criteria in 2000, making pre-participation in the Rehab programme mandatory for most applicants. 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.

⁶ 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.

⁷ Until 1998, the number of days was 14.

⁸ 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 not compensated for by SI benefits and were excluded from the calculation of medical- and work-related Rehab benefits.

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.⁹ The illness must have been certified by a physician. 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 their lives.¹⁰ 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, be actively seeking employment and be capable of working. The benefit received is 62.4% of their previous earnings up to some maximum amount.¹¹ Depending on their previous income from work, UI benefits may be received for one or two years.¹²

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 payment 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.

⁹ 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.

¹⁰ 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).

¹¹ Earnings exceeding 272,220 NOK per year in 1998 were excluded from the calculation of UI benefits.

¹² A reform to the UI programme in 1998 reduced the maximum years for the receipt of benefits from three to two.

Why the workfare reforms may lead to benefit substitution

Prior to the reforms, fewer single mothers were working; consequently, fewer single mothers were eligible for UI and SI benefits. The non-pecuniary costs of participating in the transitional benefit programme were also lower than the costs of actively engaging in Rehab programmes or 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 retirement age (Andersen *et al.*, 2002) and that single mothers have poorer mental health and worse self-reported health than married or cohabiting mothers do (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.

III. 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,¹³ 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. Our definition of married mothers includes those who cohabit with their respective partners with whom they have children. We restrict the sample to mothers who are assigned the same status (single or married) at both the beginning and the end of the calendar year. This ensures no overlaps between the groups within a given year.

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, UI benefits, SI benefits, SA payments and various benefits related to health issues and rehabilitation. The SI registry only includes spells that last longer than the number of employer-paid sick days (16 days). SA 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 have 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 difficult to measure employment. We follow Havnes and Mogstad's (2011) and Løken *et al.*'s (2017) method of using administratively set earning thresholds as proxies for hours of work. These thresholds are set by the Norwegian Social Insurance Scheme to define labour market status and determine eligibility for various benefits. The thresholds are based on a basic amount (1G),

¹³ 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 pensions.

adjusted on a yearly basis.¹⁴ Based on Havnes and Mogstad's (2011) definition, part-time employment refers to earnings above two basic amounts (2G) and full-time employment denotes earnings above four basic amounts (4G). Four basic amounts corresponds well with full-time yearly earnings in occupations such as sales, services and cleaning.

To analyse the 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.¹⁵ We then impute taxes based on this constructed gross income measure, accounting for the changing characteristics of Norwegian income tax in terms of tax rates and minimum deductible amounts during our period of study.¹⁶

Finally, we define poverty according to the OECD standard: Poverty is defined as household income below 50% of the median in the distribution of the household-equivalent disposable income. To compare households of different sizes, the first adult in the household is weighted by 1, the second adult in the household is weighted by 0.7 and each child is weighted by 0.5. A mother is defined as poor if her disposable income (plus her husband's disposable income in the case of married mothers) is lower than 50% of the weighted household-equivalent disposable income.

In Section AI of the online appendix, we present descriptive statistics for single and married mothers. Here, we provide the key takeaways from the descriptive statistics: On average, single mothers have lower employment and labour earnings compared to married mothers. Conversely, single mothers receive more benefits compared to married mothers. While single mothers' receipt of transitional benefits drastically dropped after the implementation of the reforms, their receipt of other benefits increased after the reforms, also

¹⁴ At present (2017), the basic amount equals 93,634 NOK.

¹⁵ With a few minor exceptions that do not apply to our setting, all benefits from the National Insurance Scheme are taxable.

¹⁶ 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 taxes for the 2006–2008 period. The ado command was previously available on Erik Sørensen's homepage.

compared to married mothers. Finally, while the poverty rate among married mothers is stable throughout our period of observation, it increases dramatically for single mothers in the post-reform period.

IV. Empirical strategy

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. Recall that the comparison group of married mothers was 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.

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. However, as we will show in Section V, the results from an event analysis suggest that there are (small) trends in the pre-reform differences in outcomes between single and married mothers. Therefore, we flexibly control for potential differences in the time trends between our treatment and comparison groups by including group-by-period-specific linear time trends in our difference-in-differences model. As we will show in Section V, our main findings also hold in the absence of time trends.

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

$$\begin{aligned}
y_{it} = & \beta_1 + \beta_2 S_{it} + \gamma_1(S_{it} \times Impl_t) + \gamma_2(S_{it} \times Post.ST_t) + \gamma_3(S_{it} \times Post.LT_t) \\
& + \phi_1(t \times S_{it} \times Pre_t) + \phi_2(t \times S_{it} \times Impl_t) + \phi_3(t \times S_{it} \times Post_t) \\
& + \phi_4(t \times M_{it} \times Pre_t) + \phi_5(t \times M_{it} \times Impl_t) + \phi_6(t \times M_{it} \times Post_t) + \lambda_t + \varepsilon_{it}.
\end{aligned} \tag{1}$$

Subscript i denotes the individual and subscript t denotes the year. y_{it} is the outcome variable. S_{it} is a binary variable taking the value of one if the mother is single and zero if she is married, while M_{it} is a binary variable taking the value one if the mother is married and zero if she is single. Pre_t is an indicator for the pre-reform period (1993–1997), $Impl_t$ is an indicator for the post-reform period (1998–2000) and $Post_t$ is an indicator for the post-reform period (2001–2008). To facilitate the investigation of the short-term versus long-term effects of the reforms, the model also includes indicators for the short-term post-reform period ($Post.ST_t$) and the long-term post-reform period ($Post.LT_t$). t is a linear trend variable and λ_t is a vector of yearly fixed effects. Our coefficients of interest are γ_1, γ_2 and γ_3 . These coefficients measure the effect of the phase-in of the reforms, as well as the short-term and long-term post-reform effects. Finally, ε_{it} 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 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-reform, phase-in and post-reform). We cluster all standard errors in the main analysis on treatment \times year.¹⁷

¹⁷ This implies 32 clusters, which admittedly may be at the lower limit for clustered errors.

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 coefficients of interest, γ_1 , γ_2 and γ_3 , are identified only for those mothers who are observed 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 on 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 accurately capture the total effects of the reforms on net public expenses.

The main drawback of not including individual fixed effects in our main specification is that our approach is more vulnerable to compositional changes in the groups of single and married mothers. As we showed in Section III and will discuss further in Section V, we do observe clear signs of compositional changes. We outline how we deal with these compositional changes in the following subsection. Also, as we will show in Section V, the main conclusions hold when including individual fixed effects in the model.

Confounding effects and compositional changes

If the reforms had causal effects on outcomes other than labour market outcomes and the receipt of benefit payments, it would be more complicated to isolate the causal effects on the outcomes that we are studying. We are mainly concerned with two potential effects of the reforms. First, because the reforms make it costlier to be a single mother, they could increase marriage rates among single mothers and/or decrease divorce rates among married mothers. However, we find little evidence of such an effect in the data, as both the share of single mothers and the marriage rate remain relatively stable around the time of the reforms (see Figure A3 in the online

appendix). Second, because single mothers of children below three years of age do not face a tightening up of work requirements after the reforms, the reforms could cause an increase in birth rates among single mothers. Again, we find no reform effect on the likelihood of having a child in the phase-in or post-reform periods.¹⁸ 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. This criterion does not appear to hold in our setting (see Section AII in the online appendix). There are clear differences in the raw trends in outcome variables for single and married mothers. Furthermore, the results from a balancing test show that even when controlling for group-by-period-specific time trends, we find positive post-reform effects on four out of five covariates. Therefore, there are clear indications that compositional changes in the treatment and the comparison groups may dilute the effects of the reforms.

To deal with the compositional changes in our treatment and comparison groups, we reweight our control group of married mothers to balance the covariate distributions of single and married mothers across our period of observation.¹⁹ As a result, our main specification equals a matched difference-in-differences analysis implemented by weighting. Intuitively, within each year, married mothers who resemble single mothers in that year are weighted more. When estimating the difference-in-differences model specified in Equation (1), we weight each married mother with the following weight:

$$\hat{\omega}_i(X_i) = \frac{p\widehat{score}_i(X_i)}{1-p\widehat{score}_i(X_i)} \times \frac{1-\widehat{\Pr}(D_i=1)}{\widehat{\Pr}(D_i=1)}, \quad (2)$$

¹⁸ Results available upon request.

¹⁹ We thank the anonymous referee who suggested this and the editor Peter Fredriksson, who helped us with the details of implementing the weighting approach.

where $\widehat{pscore}_i(X_i)$ is the propensity score for being a single mother, estimated based on our covariates measured in 1997.²⁰ $\widehat{\Pr}(D_i = 1)$ is the share of single mothers. By reweighting the control group and not the treatment group, this weighting approach implies that our estimates should be interpreted as the ATT (see Li *et al.*, 2018, for a more detailed explanation on this). The key identifying assumption for the weighted version of the difference-in-differences model specified in Equation (1) is that the common-trend assumption holds when adjusting for the compositional changes in the pre-treatment covariates by weighting the control group.

After adjusting for compositional changes by weighting, we re-estimate the balancing test on pre-reform covariates. The results are reported in Table 2. Although we still find some significant effects of the reform on the covariates, the statistically significant coefficients are few and small in size. In the phase-in period, the only significant coefficient signals a 21% reduction in the share of immigrants in the group of single compared to married mothers. In the short-term post-reform period, the only significant coefficient signals a 7% reduction in college graduates in the group of single compared to married mothers. In the long-term post-reform period, we find positive effects on three out of the five covariates: a 1.6% increase in average age, a 6.7% reduction in college graduates and a 0.3% increase in the number of children in the group of single mothers compared to married mothers. Therefore, the combined approach of applying group-by-period-specific time trends and reweighting the control group of married mothers reduces the problems of compositional changes to a minimum.

²⁰ 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`.

Table 2. Balancing test

Covariate	Phase-in effects 1998–2000	Short-term effects 2001–2004	Long-term effects 2005–2008	Pre-reform mean for single mothers
Age in 1997	0.539 (0.300)	0.332 (0.161)	0.540** (0.142)	32.98
College degree by 1997	−0.009 (0.003)	−0.011** (0.003)	−0.010** (0.002)	0.15
# of children in 1997	0.261 (0.105)	−0.033 (0.040)	0.006** (0.037)	1.82
Immigrant	−0.015* (0.005)	−0.002 (0.003)	−0.003 (0.003)	.07
Local female unempl. rate in 1997	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	.05
Year FE	yes	yes	yes	
Group×period time trends	yes	yes	yes	
N	4,231,745			

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

V. Results

Year-by-year effects

To assess the common-trend assumption of the difference-in-differences model more formally, we start by presenting the results from an event analysis. Specifically, we define 1997 as the base year and then separately estimate the model, as follows:

$$y_{it} = \beta_1 + \beta_2 \text{Single}_{it} + \gamma_1 \text{Year}_{t \neq 1997} + \gamma_2 (\text{Year}_{t \neq 1997} \times \text{Single}_{it}) + \varepsilon_{it}, \quad (3)$$

for each year between 1993 and 2008 (except, of course, for the base year).²¹ The advantage of the event analysis compared to inspecting the raw trends in outcomes is that it explicitly controls for year-fixed effects and covariates (through our weighting approach described in Section IV).

²¹ For transitional benefits, married mothers do not form a valid control group, so the model reduces to a single difference model comparing average payments to single mothers in a given year to the payments in the base year of 1997.

If the common-trend assumption holds true, we should expect γ_2 to be close to zero and statistically insignificant for the pre-reform years (1993–1996).²²

Figures 1 and 2 plot the estimated year-by-year effects separately for each of our outcomes. For most outcomes, γ_2 is close to zero for all the pre-reform years (1993–1996). However, there are some signs of pre-reform trends. For SA benefits, total benefit payments, labour earnings, disposable income and full-time employment, there is a negative trend for single mothers compared to married mothers in the pre-reform years. For poverty, UI and Rehab benefits, there is a slight positive trend for single mothers compared to married mothers in the pre-reform years. The pre-reform differences we estimate for the various outcomes are small compared with the corresponding post-reform effects on each outcome. However, the presence of pre-reform trends in the event analysis is our main motivation for including group-by-period-specific linear time trends in our main empirical model, as discussed in Section IV.

Another benefit of the event analysis is that it allows us to investigate how the potential effects of the reforms vary over the post-reform years. Looking at the impact on payments from the various benefit programmes (presented in Figure 1), we find immediate positive effects during the phase-in period for all outcomes except SA benefits. These positive effects stabilise in the post-reform period, except for DI benefits, for which the effect size continues to increase in the post-reform period. The reforms discussed in Section II explain the drop in SI benefits in 2005 and the observed change in Rehab benefits between 2001 and 2002.

Turning to the phase-in and post-reform effects on our other outcomes (presented in Figure 2), we find positive but decreasing effects on total benefit payments during the phase-in period, followed by a clear shift to negative year-by-year effects during the post-reform period. For both labour earnings and disposable income, there are positive and increasing reform effects

²² We cluster standard errors at the individual level, as the group \times year level only yields four clusters in this setup.

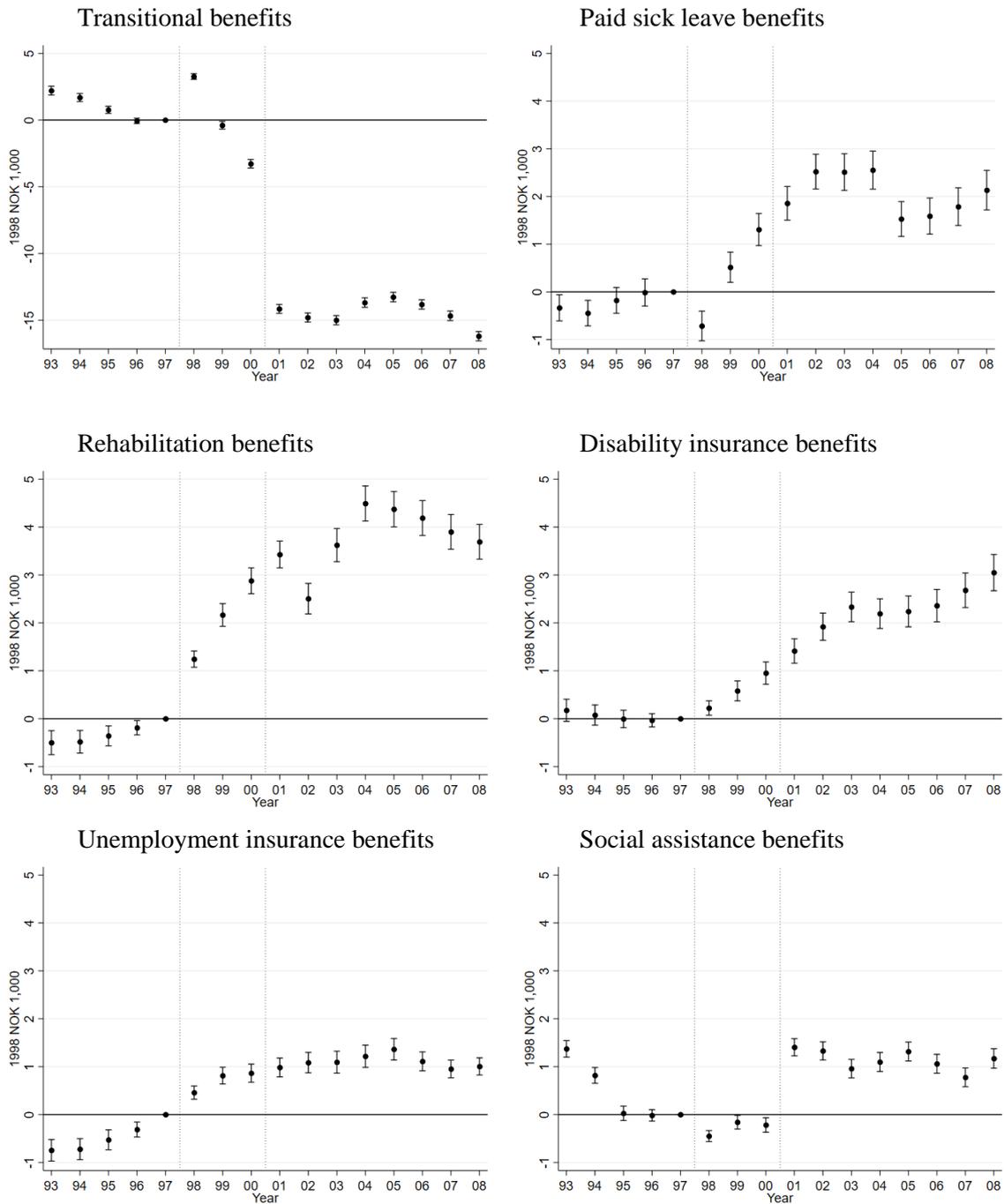


Figure 1: Transitional benefit payments and year-by-year effects on various benefit payments
Notes: Coefficients with 95% confidence intervals (SEs clustered at the individual level). Each observation is weighted by the inverse of her propensity score. The base year is 1997. The vertical lines indicate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

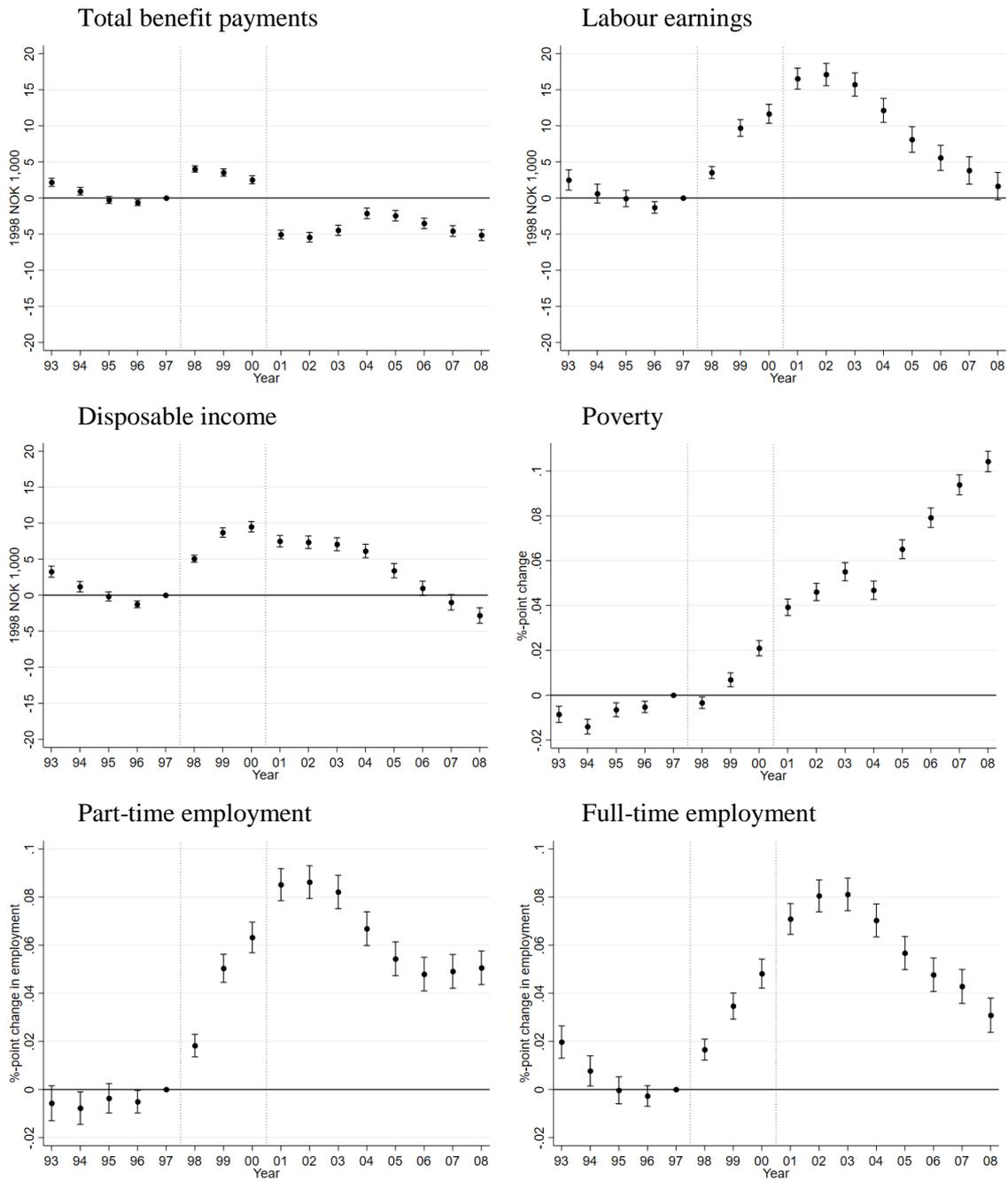


Figure 2: Year-by-year effects on total benefits, income, employment and poverty

Notes: Coefficients with 95% confidence intervals (SEs clustered at the individual level). 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 are measured in 1,000 NOK at 1998 prices. Poverty is defined according to OECD standards: Disposable income of less than 50% of the median in the distribution of household-equivalent disposable income.

which peak in 2000 for disposable income and in 2002 for labour earnings, before diminishing. We estimate negative long-term effects of the reforms on disposable incomes in 2008. For poverty, the results are dramatic. Post-reform, there is a positive and linearly increasing effect on the poverty rate of single mothers having an income below the poverty line. Finally, we find positive and increasing year-by-year effects on part-time and full-time employment, which peak in 2002–2003 before diminishing.

Main results: Benefit substitution

In this section, we present the main results regarding benefit substitution. The main results are obtained by estimating the difference-in-differences model specified in Equation (1) using an OLS regression. For presentational convenience, we focus on the short- and long-term post-reform effects and mostly disregard the phase-in period. This also applies to the following sections where we present our main results.

Row (A) in Table 3 shows that the reforms decreased the single mothers' receipt of transitional benefits by around 13,000 NOK per year in the short- and long-term post-reform period, corresponding to approximately a 40% decrease in payments.²³ 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 prompted significant behavioural responses in single mothers in terms of benefit substitution and labour market participation.

Rows (B) to (F) in Table 3 show that the reforms resulted in considerable benefit substitution. Focusing on benefit substitution by switching to health-related benefit

²³ 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 re-estimate the model specified in Equation (1) without the period-specific trends for married mothers and the indicator for single mother status. In this specification, the coefficients of interest, γ_1 , γ_2 and γ_3 , estimate the changes in the mean outcomes in the phase-in and the post-reform periods relative to the pre-reform period for single mothers.

Table 3. Impact on benefits, earnings, income, taxes and public expenses

Outcome	Phase-in effects 1998–2000	Short-term effects 2001–2004	Long-term effects 2005–2008	Pre-reform mean for single mothers
(A) Transitional benefits ^{a)}	-1,011 (1,646)	-12,618** (1,140)	-13,350** (1,521)	30,681
(B) SI benefits	-76 (475)	2,271** (147)	1,726** (205)	3,392
(C) Rehab benefits	1,985** (437)	3,223** (305)	3,937** (139)	2,637
(D) DI benefits	431 (225)	1,231** (139)	2,075** (187)	2,264
(E) UI benefits	1,178** (185)	1,386** (166)	1,420** (165)	3,413
(F) SA benefits	-1,156** (316)	191 (376)	131 (317)	3,814
(G) Total benefits (A + B + C + D + E + F)	4,211** (739)	-4,664** (1,052)	-4,303** (1,015)	46,200
(H) Labour earnings	9,413 (4,123)	20,482** (2,511)	10,106** (2,222)	98,128
(I) Gross income (G + H)	13,623* (3,905)	15,818** (2,153)	5,803 (2,409)	144,329
(J) Taxes	4,542** (1,337)	3,516** (149)	-85 (194)	39,222
(K) Disposable income (I - J)	9,082** (2,570)	10,058** (1,396)	3,327 (1,600)	105,107
(L) Net public expenses (G - J)	-331 (1,663)	-10,423** (1,378)	-6,779** (1,078)	6,978
Year FE	yes	yes	yes	
Group × period time trends	yes	yes	yes	
N		4,231,745		

Notes: All outcomes measured in NOK at 1998 prices. ** and * indicate significance at the 1% and 5% levels, respectively (SEs clustered at group × year. ^{a)} The estimated reform effects on transitional benefits capture the changes in mean outcomes in the phase-in and the post-reform periods relative to the pre-reform period for single mothers only (before-and-after estimates, N = 795,451).

programmes, Rows (B), (C) and (D) indicate that the short-term effects of the reforms include a 2,271-NOK increase in SI, a 3,223-NOK increase in Rehab benefits and a 1,231-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 67%, 122% and 54% increases in the above-mentioned benefit payments, respectively.

However, part of the increase in SI is mechanical, since SI receipt is conditional on employment and, as shown in Table 4, the reforms increased 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:²⁴

$$\Delta Total SI benefits = \underbrace{[\Delta empl. \times \overline{SI benefits}]}_{mechanical\ effect} + indirect\ effect, \quad (4)$$

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 a 9.8-percentage point increase (Row (M) in Table 4)²⁵. For the period from 1993 to 2008, we calculate that mothers with at least part-time employment received 8,041 NOK in SI benefits on average each year. Mothers who worked less than part time received 979 NOK in SI benefits on average each year. The mechanical effect of the reforms on SI benefits is therefore equal to a 692-NOK²⁶ increase in SI benefits. Thus, as much as 70% of the observed short-term increase in SI benefits comes from an indirect behavioural response.

²⁴ We thank the anonymous referee who suggested this decomposition exercise.

²⁵ Recall that our definition of part-time employment includes the full-time employed.

²⁶ $(8041 - 979) \times 0.098 = 692$.

The increases in benefit payments from health-related welfare programmes persist over the long term. The persistent long-term effects of the reforms on benefit substitution with health-related 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 do (see Section II). 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 1,386 NOK (in relative terms, 41%). This effect persists over the long term. For SA payments [Row (F)], we find no effects of the reforms in 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 4,664 NOK per year in the short term and 4,303 NOK per year in the long term. These findings imply that due to benefit substitution, the overall loss in total benefits is only around one-third of the loss in transitional benefits. In other words, our analysis implies that for every 100 NOK of lost transitional benefits, around 65 NOK is replaced by payments

from other benefit programmes. 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.

Main results: Labour market responses

We report the effects of the reforms on employment rates in Table 4. The estimated short-term effects are large. The reforms increased the single mothers' part-time employment rates by 9.8 percentage points (20%) and full-time employment rates by 8.6 percentage points (32%). These short-term effects of the reforms diminish in the long term: We estimate a 6.9-percentage point increase in part-time employment and a 5.7-percentage point increase in full-time employment. These long-term effects of the reforms are still substantial: Relative to the pre-reform means of single mothers, the estimated effects correspond to a 14% and a 21% increase in part- and full-time work for single mothers, respectively.

Table 4. Impact on employment and poverty

Outcome	Phase-in effects 1998–2000	Short-term effects 2001–2004	Long-term effects 2005–2008	Pre-reform mean for single mothers
(M) Part-time employment	0.051* (0.019)	0.098** (0.008)	0.069** (0.007)	0.481
(N) Full-time employment	0.035 (0.016)	0.086** (0.009)	0.057** (0.008)	0.271
(O) Poverty	0.003 (0.005)	0.042** (0.003)	0.083** (0.007)	0.074
Year FE	yes	yes	yes	
Group × period time trends	yes	yes	yes	
N		4,231,745		

Notes: ** and * indicate significance at the 1% and 5% levels, respectively (SEs clustered at group × year). Poverty is defined according to OECD standards: Disposable income of less than 50% of the median in the distribution of household-equivalent disposable income.

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 increased labour earnings by 20,482 NOK in the short term, corresponding to a 21% increase compared with the pre-reform mean labour earnings of single mothers. The result implies that, on average, single mothers more than fully compensate for the loss of total benefit payments caused by the reforms by increasing their labour earnings. We estimate that the long-term effect of the reforms on labour earnings diminishes to a 10,106-NOK increase. This is still higher than the estimated decrease in total benefit payments in the long term.

Main results: Overall impact on private and public finances

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. As shown in Row (I) of Table 3, the estimated short-term effect of the reforms on gross income is a 15,818-NOK increase. The picture changes slightly in the long term. The loss in total benefit payments persists over the long term, while the positive effect on labour earnings diminishes by 50%. We still estimate a positive long-term effect of the reforms on gross income (a 5,803-NOK increase), but the coefficient is not statistically significant.

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 3,516 NOK in the short term, a 9% increase compared with the pre-reform baseline. We find no statistically significant long-term effect of the reforms on taxes. The estimated effects on taxes allow us to calculate the net financial gains or losses 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 10,058 NOK, corresponding to a 9.6% raise relative to the pre-reform level. This finding contrasts with Mogstad and Pronzato's (2012, p. 1149) finding that the weighted effect of the reform on disposable income among "new" and "lasting" single mothers was a yearly 241-EUR (in 1998 prices) decrease in the very short term (2001).²⁷ This corresponds to a 1,947-NOK (in 1998 prices) decrease when converted using the exchange rate in 1998. We also find a positive long-term effect of the reforms on single mothers' disposable income (a 3,327-NOK increase). However, this coefficient is not statistically significant.

Second, we estimate the effects of the reforms on the average net public expenditure 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 10,423 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 four times the average population of single women in the 2001–2004 period (52,033), amounting to approximately 2.2 billion NOK at 1998 prices.²⁸ The long-term effect of the reforms on net public expenses is somewhat smaller, but we still estimate an average decrease of 6,779 NOK per year per single mother 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 1.4 billion NOK at 1998 prices.²⁹ Including the total gains in public expenditures during the phase-in period,³⁰ the reforms saved taxpayers 3.6 billion NOK

²⁷ Mogstad and Pronzato (2012) find that in the very short term, the reforms increase disposable income by 2,447 EUR for "newly lone mothers" but decrease the disposable income of "lasting lone mothers" by 844 EUR.

²⁸ $10,423 \text{ NOK} \times 52,033 \times 4 = 2,169,359,836 \text{ NOK}$

²⁹ $6,779 \text{ NOK} \times 50,515 \times 4 = 1,369,764,740 \text{ NOK}$

³⁰ $331 \text{ NOK} \times 49,942 \times 3 = 49,592,406 \text{ NOK}$

(at 1998 prices) in public expenses from the year it was introduced (1998) to 2008.³¹ Of this gain to public expenses, roughly half comes from reduced benefit payments and half comes from increased income taxes.

The public finance impact only provides a partial answer to the economic implications of the reforms. However, we do not perform a social welfare analysis of the impacts of the reform, as such an assessment must be based on fundamentally unobservable factors such as single mothers' valuation of leisure and the welfare weights attached to low-income households. Yet, our results on the impacts of the reforms on poverty (presented in Row (O) of Table 4) do provide evidence that the reforms had significant negative consequences for some single mothers. In the short term, the reforms increased the poverty rate among single mothers by 4.2 percentage points (57%). Our finding confirms Mogstad and Pronzato's (2012, p. 1149) finding that the weighted effect of the reform on poverty rates among "new" and "lasting" single mothers was a 2.7-percentage point increase in the very short term (2001). In the long term after the reforms, the impact on poverty doubles. Combined with our finding that the reforms increased average disposable income among the population of single mothers, the increase in poverty rates also implies that income inequality must have increased among single mothers as a result of the reforms.

Controlling for individual fixed effects

In this section, we present our results from a specification including individual fixed effects in the model specified in Equation (1). The inclusion of individual fixed effects in the model controls for all potential time-invariant individual confounders. The drawback of this specification is, as discussed in Section IV, that we only identify the reform effects on the mothers observed in both the pre-reform and the post-reform periods (termed "lasting single

³¹ 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.

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 specification including individual fixed effects are presented in Tables 5 and 6. Most results are similar to our main results. However, there are some notable exceptions. With individual fixed effects, we find stronger negative effects of the reforms on transitional benefits: a yearly 17,006-NOK decrease in the short term and a yearly 21,489-NOK decrease in the long term. However, we find larger degrees of benefit substitution, so the estimated impact on total benefit payments is approximately similar to the results from the specification without individual fixed effects.

For labour earnings, the estimated effect is smaller in size when we include individual fixed effects in the model: a yearly 11,335-NOK increase in the short term, corresponding to 55% of the baseline estimate. This estimate is in line with the reform effect on labour earnings that Mogstad and Pronzato (2012) find for lasting single mothers. They estimate an increase in labour earnings for this group of 1,116 EUR (in 1998 prices), which corresponds to a 9,017-NOK (in 1998 prices) increase when converted using the exchange rate in 1998. Also, we find smaller short-term effects of the reforms in terms of part- and full-time employment when we include individual fixed effects in the model specification. However, the specifications with and without individual fixed effects give similar results in terms of the long-term effect of the reforms on part- and full-time employment and labour earnings.

When including individual fixed effects in the model, we also find smaller short-term impacts of the reforms on disposable income: 4,337 NOK per year compared to the baseline estimate of 10,058 NOK. Looking at the long-term effect of the reforms on disposable income, the effect is roughly similar regardless of whether or not we include individual fixed effects in the model, although it is statistically significant only in the model which includes individual fixed effects.

Table 5. Including individual FEs: Impact on benefits, earnings, income, taxes and public expenses

Outcome	Phase-in effects 1998–2000	Short-term effects 2001–2004	Long-term effects 2005–2008	Pre-reform mean for single mothers
(A) Transitional benefits ^{a)}	–492** (140)	–17,006** (142)	–21,489** (153)	30,681
(B) SI benefits	930** (166)	3,716** (146)	4,170 ** (192)	3,392
(C) Rehab benefits	2,124** (148)	3,589** (172)	4,549** (235)	2,637
(D) DI benefits	846** (107)	1,868** (144)	2,840** (209)	2,264
(E) UI benefits	1,494* (185)	1,889** (107)	2,216** (127)	3,413
(F) SA benefits	–635** (78)	1,482** (85)	1,907** (104)	3,814
(G) Total benefits (A + B + C + D + E + F)	3,679** (277)	–4,198** (296)	–5,592** (396)	46,200
(H) Labour earnings	3,350** (522)	11,335** (611)	9,027** (862)	98,128
(I) Gross income (G + H)	7,028** (489)	7,137** (563)	3,435** (809)	144,329
(J) Taxes	2,543** (183)	2,800** (210)	1,670** (308)	39,222
(K) Disposable income (I – J)	4,486** (313)	4,337** (360)	1,765** (512)	105,107
(L) Net public expenses (G – J)	1,136** (305)	–6,997** (347)	–7,262** (479)	6,978
Year FE	yes	yes	yes	
Group × period time trends	yes	yes	yes	
Individual FE	yes	yes	yes	
N		4,231,745		

Notes: All outcomes measured in NOK at 1998 prices. ** and * indicate significance at the 1% and 5% levels, respectively (standard errors clustered at group × year). ^{a)} The estimated reform effects on transitional benefits capture the changes in mean outcomes in the phase-in and the post-reform periods relative to the pre-reform period for single mothers only (before-and-after estimates, N = 795,451).

Table 6. Including individual FEs: Impact on employment and poverty

Outcome	Phase-in effects 1998–2000	Short-term effects 2001–2004	Long-term effects 2005–2008	Pre-reform mean for single mothers
(M) Part-time employment	0.032** (0.003)	0.075** (0.03)	0.074** (0.004)	0.481
(N) Full-time employment	0.009** (0.003)	0.045** (0.003)	0.047** (0.003)	0.271
(O) Poverty	0.024** (0.002)	0.090** (0.002)	0.150** (0.002)	0.074
Year FE	yes	yes	yes	
Group × period time trends	yes	yes	yes	
Individual FE	yes	yes	yes	
N		4,231,745		

Notes: ** and * indicate significance at the 1% and 5% levels, respectively (standard errors clustered at group × year). Poverty is defined according to OECD standards: Disposable income of less than 50% of the median in the distribution of household-equivalent disposable income.

Looking at poverty, the effect of the reforms in both the short and long term approximately doubles when we include individual fixed effects in the model. In the short term, we estimate a 9.0-percentage point (122%) increase in poverty rates, while in the long term, we estimate a 15.0-percentage point (203%) increase in poverty rates. Our short-term estimate is larger than Mogstad and Pronzato’s (2012) estimated reform effect of a 3.5-percentage point increase in poverty rates for lasting single mothers. However, as shown in Figure 2, the effect of the reform on poverty increases linearly in the post-reform period, and our short-term estimate of the reform effect is for the period 2001–2004, while Mogstad and Pronzato’s (2012) estimate is only for 2001.

Finally, including individual fixed effects in the model somewhat reduces the total effect of the reforms on net public expenses. Remember that in the baseline specification, we estimated the net gain to public expenses as approximately 4 billion NOK in 1998 prices. When

we include individual fixed effects in the model, this reduces to a net gain of approximately 2.8 billion NOK in 1998 prices.

Sensitivity analysis: Specification and robustness checks

Our main results are robust to a wide range of alternative specifications, shown in Section AIII of the online appendix. First, the results are not driven by our weighting approach. When we estimate the difference-in-differences model specified in Equation (1) by controlling for compositional changes with linear control variables instead of weighting, the estimates are similar to the main results. Second, the results are not driven by our group-by-period-specific trends. In alternative specifications with either i) no trend variables in the model, or ii) adding group-by-period-specific quadratic time trends to the model, the results are in line with our main results. Third, the results are not driven by an increasing proportion of immigrant mothers in Norway over time. When we exclude immigrants from the sample, the estimates are very close to the main results. Fourth, to address any potential concerns that our results are driven by a contemporaneous reform that introduced cash-for-care subsidies, we show that our estimates are robust to excluding mothers with children aged one to three who are eligible for cash-for-care benefits.

A final potential concern is that our main approach might potentially inflate the precision of our results because of serial correlation, as employment, earnings and the receipt of benefits are unlikely to be annually independent states. However, our main results are confirmed by the results from the event analysis presented earlier, which accounts for any potential serial correlation by comparing the base year of 1997 to just one pre-reform, phase-in or post-reform year in each regression. Also, in an alternative specification (outlined in Section AIV of the online appendix), we deal with potential serial correlation in an alternative specification by aggregating the data to just two groups in each period by constructing the means of the outcome variables for each individual in each separate period. The results from

this approach, which is the most conservative approach for tackling potential serial correlation, do not alter the conclusions from our main results.

VI. Conclusion

In this paper, we analysed 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 40%. We find considerable benefit substitution in response to the reforms: For each 100-NOK reduction in targeted transitional benefits, single mothers replace approximately 65 NOK through increased uptake of other benefit programmes, mainly health-related benefits. Moreover, we find that the reforms resulted in a sizeable positive labour supply response among the affected single mothers. 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 little, if any, long-term effect on the disposable income of the affected single mothers. Also, note that the positive impact of the reforms on average disposable income masks the fact that some single mothers were disproportionately negatively affected by the reforms. In the long term, we estimate that the reforms increase the poverty rate among single mothers by 112%.

The reforms significantly reduced overall costs to taxpayers. We estimate the total net gain to public expenses to be 3.6 billion NOK over the period from 1998 to 2008. Of the total gain to public expenses, roughly half comes from reduced benefit payments and half comes from increased income taxes.

However, we do wish to note that there are compositional changes in the treatment and comparison groups. The causal interpretation of our findings is based on the assumption that

the common-trend assumption holds conditional on the group-by-period specific linear time trends we include in our main specification and the reweighting strategy we employ to adjust for these compositional changes. Also, note that the estimated total effect on 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 such as that by Inderbitzin *et al.* (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 in terms of public finances.

References

- Andersen, A.S., Birkeland, E., Epland, J. and Kirkeberg, M.I. (2002), Økonomi og Levekår for Ulike Grupper Trygdemottakere, 2001 (The Economic Welfare of Welfare Recipients, 2001), Statistics Norway Reports 2002/20.
- Blank, R.M. (2002), Evaluating Welfare Reform in the United States, *Journal of Economic Literature* 40 (4), 1105–1166.
- Bloemen, H., Hochguertel, S. and Lammers, M. (2013), Job Search Requirements for Older Unemployed: Transitions to Employment, Early Retirement and Disability Benefits, *European Economic Review* 58, 31–57.
- Blundell, R., Brewer, M. and Shephard, A. (2005), Evaluating the Labour Market Impact of Working Families' Tax Credit using Difference-in-Differences, HMRC Working Paper 4.
- Borghans, L., Gielen, A.C. and Luttmer, E.F.P. (2014), Social Support Substitution and the Earnings Rebound: Evidence from a Regression Discontinuity in Disability Insurance Reform, *American Economic Journal: Economic Policy* 6 (4), 34–70.
- Brady, D. and Burroway, R. (2012), Targeting, Universalism and Single Mother Poverty: A Multi-Level Analysis Across 18 Affluent Democracies, *Demography* 49, 719-746.
- Drange, N., Havnes, T. and Sandsør, A.M.J. (2016), Kindergarten for All: Long Run Effects of a Universal Intervention, *Economics of Education Review* 53, 164-181.
- Eissa, N. and Liebman, J.B. (1996), Labour Supply Response to the Earned Income Tax Credit, *The Quarterly Journal of Economics* 111 (2), 605–637.
- Finn, D. and Gloster, R. (2010), Lone Parent Obligations. A Review of Recent Evidence on the Work-related Requirements within the Benefit Systems of Different Countries, Department for Work and Pensions Research Report 632.
- Francesconi, M. and van der Klaauw, W. (2007), The Socioeconomic Consequences of “In-work” Benefit Reform for British Lone Mothers, *The Journal of Human Resources* 42 (1), 1–31.
- Garrett, B. and Glied, S. (2000), Does State AFDC Generosity Affect Child SSI Participation?, *Journal of Policy Analysis and Management* 19 (2), 275–295.
- Havnes, T. and Mogstad, M. (2011), Money for Nothing? Universal Child Care and Maternal Employment, *Journal of Public Economics* 95, 1455–1465.
- Henningsen, M. (2008), Benefit Shifting: The Case of Sickness Insurance for the Unemployed, *Labour Economics* 15, 1238–1269.
- Inderbitzin, L., Staubli, S. and Zweimüller, J. (2016), Extended Unemployment Benefits and Early Retirement: Program Complementarity and Program Substitution, *American Economic Journal: Economic Policy* 8 (1), 253–288.

- Karlström, A., Palme, M. and Svensson, I. (2008), The Employment Effect of Stricter Rules for Eligibility for DI: Evidence from a Natural Experiment in Sweden, *Journal of Public Economics* 92, 2071–2082.
- Knoef, M. and Ours, J.C.van. (2016), How to Stimulate Single Mothers on Welfare to Find a Job: Evidence from a Natural Experiment, *Journal of Population Economics* 29, 1025-1061.
- Kostøl, A.R. and Mogstad, M. (2014), How Financial Incentives Induce Disability Insurance Recipients to Return to Work, *American Economic Review* 104 (2), 624–655.
- Li, F., Morgan, K.L. and Zaslavsky, A.M. (2018), Balancing Covariates via Propensity Score Weighting, *Journal of the American Statistical Association* 113, 390-400.
- Løken, K.V., Lundberg, S. and Riise, J. (2017), Lifting the Burden: Public Care of the Elderly and the Location and Labor Supply of Adult Children, *Journal of Human Resources* 52, 247–271.
- Meyer, D.B. and Rosenbaum, D.T. (2001), Welfare, the Earned Income Tax Credit, and the Labour Supply of Single Mothers, *The Quarterly Journal of Economics* 116 (3), 1063–1114.
- Moffitt, R. (2007), Welfare Reform: The US Experience, *Swedish Economic Policy Review* 14 (2), 11–47.
- Mogstad, M. and Pronzato, C. (2012), Are Lone Mothers Responsive to Policy Changes? Evidence from a Workfare Reform in a Generous Welfare State, *Scandinavian Journal of Economics* 114 (4), 1129–1159.
- Ochel, W. (2005), Hartz IV – Welfare to Work in Germany, CESifo Report 2/2005.
- Omholt, E.L. (2016), Økonomi og Levekår for Ulike Lavinntektsgrupper 2016 (The Economic Welfare of Low Income Groups 2016), Statistics Norway Reports 2016/30.
- Schmidt, L. and Sevak, P. (2004), AFDC, SSI, and Welfare Reform Aggressiveness. Caseload Reduction versus Caseload Shifting, *The Journal of Human Resources* 39 (3), 792–812.
- Ugreninov, E. (2005), Levekår blant Alenemødre (The Economic Welfare of Single Mothers), Statistics Norway Reports 2005/7.