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EXPERIMENTAL ANALYSIS OF WELLBEING OF PARENTS WITH SPECIAL NEEDS CHILDREN IN NORDIC STATES

Testing Theoretical Predictions Using oTree Framework

Faculty of Social Sciences
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Abstract

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This study develops a theoretical model that combines both statistical discrimination and gift exchange, extending existing theories, to explain how differential parental-leave probabilities may influence the employment relationship in a Nordic welfare context. This theory also generates further predictions regarding wage discrimination, effort provision, and household coordination, which are tested in an experiment consisting of 78 participants (52 workers, 26 employers) organized into 26 three-person groups making decisions over 20 rounds. Using a modified gift exchange game, assign workers with different probabilities of receiving leave (10% and 50%) to mimic the difference between intensive care versus typical families. The design makes it possible to identify causal effects that cannot be isolated when working only with observational data due to confounding variables including individual labor market attachment, generosity of benefits, and socioeconomic status, among others, and unmeasured productivity characteristics. The results provide strong evidence for statistical discrimination: higher-leave probability workers are systematically paid less (−9.07, $p < 0.001$) than their peers, although they have the same productivity. The discrimination displays a "ceiling effect" where extended leave duration does not proportionally increase penalties beyond initial probability difference (T1: -17.64 vs. T2: -18.67, difference = 1.03). Gift exchange relations survive under discrimination with a stronger wage-effort correlation for discriminated workers (0.689 against 0.414), suggesting reciprocal behavior strengthens as a coping mechanism. Communication allows partial mitigation through household coordination, reducing the wage gap by 24.4% when workers can coordinate leave-taking and earnings sharing. The theoretical framework shows how well-intentioned family policies result in adverse labor market discrimination due to the costs perceived by the employers, thus explaining the "Nordic paradox" wherein generous welfare states impose higher relative resource burdens on parents. The policy analysis indicates that the risk-pooling mechanisms that eliminate the individual employer costs could be discrimination while maintaining the family support, with the universal benefits being more effective than the targeted one. Findings link the experimental economics with the family policy analysis, providing the first formal model of how parental leave policies affect the families with children who need intensive care in the Nordic welfare context.

Keywords: Statistical discrimination, gift exchange, parental leave, Nordic welfare state, experimental economics, family policy

JEL Classification: J16, J71, C92, I38

USE OF AI IN THESIS

I have utilised AI tools in my thesis:

☐ No

☒ **Yes**

The AI tools utilised in my thesis and their purposes are described below:

Names and versions of AI tools:

- Python programming language
- Claude AI (Anthropic's language model)

Purpose of using AI tools:

- Python programming language was used to conduct data analysis, statistical testing, and image generation for visualizing experimental results rather than using traditional economics and statistics software packages
- Claude AI was used to understand research papers more in-depth, understand grading requirements and check the thesis according to academic criteria, and provide assistance in writing code for data analysis. It also helped in understanding and helping in interpreting the results of the statistical analysis performed. Additionally, it assisted in organizing and formatting complex mathematical derivations, ensuring consistency in mathematical notation and formatting, and structuring theoretical propositions.

Sections where AI tools were used:

- Data analysis sections (Section 5: Results) - statistical analysis and helping with interpretation
- Statistical model coding and implementation - Python-based analysis
- Interpretation of statistical results and findings - understanding outputs
- Thesis structure and criteria verification - ensuring academic standards
- Mathematical Appendix and policy recommendations - ensuring notation consistency and systematic framework organization
- Technical writing refinement - improving clarity and academic language in complex theoretical sections

I acknowledge that I am fully responsible for the entire content of my thesis, including the parts generated by AI, and accept accountability for any violations of ethical standards in publications.

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1. Introduction

1.1 The Challenge of Caregiving in Modern Welfare States

Caring for children with special needs has distinct challenges for families that are beyond conventional parenting. Nordic welfare states are usually known for their broad family support and gender equality, but still, these families struggle with complex issues between caregiving responsibilities, Labor market participation, and economic security. These countries have established extensive disability support systems and generous parental leave policies; literature indicates that even these extensive welfare systems still fall short of adequately addressing the long-term economic consequences faced by families providing intensive caregiving.

Caring for children with special needs can have serious and long-lasting effects on families, both socially and economically. Unlike conventional parental leave, which usually lasts for a few months, families with children with special needs might need to provide intensive caregiving for periods that can last several years, which will create an extended absence from the Labor market that will compound over time. Recent policy research demonstrates, “any parental leave taken can last years, if not decades” for these families, leading to “a loss of career opportunities and a decline in skills, which can impact future employment possibilities” (Sieberg, 2024, p. 3 – WP3 File). This can be harmful to the economic well-being of a family, impacting not only immediate income but also the ability to make long-term plans for the family, such as retirement savings and economic mobility for children.

Examining caregiving responsibilities through a gender lens becomes increasing complex. Research indicates women incur disproportionate shifts in their careers and face permanent wage losses due to long caregiving responsibilities, adding to the already existing gendered economic disparities in the Labor market. Coupled with the emotional and financial burdens of looking after children with special needs, these economic impacts can lead to increased instability within families, with research noting that "many couples divorce, further endangering the economic prospects for the parent who has stayed home to care for the child" (Sieberg, 2024, p. 3 - WP3 File).

1.2 Nordic Paradox Welfare with Challenges

Examining the Nordic welfare states presents distinct challenges: These countries have implemented universal healthcare, generous parental leave, comprehensive disability services, and employment policies and protections against employment discrimination. These policies theoretically provide support for families to undertake lengthy caregiving responsibilities while maintaining financial stability and gender equality.

Literature highlights the "Nordic paradox" wherein the most welfare state-oriented countries with family policies supportive of parents actually place higher resource burdens on caregivers than other European countries. According to literature review studies, Sweden and Finland practice the highest ratio of parental contribution in Europe. This means that parents contribute nearly three times more total resources, which include time, money, and taxes, as compared to non-parents toward child-rearing, suggesting that even the most generous welfare states tend to underestimate the cost of intensive caregiving in the case of children with special needs (Institute for Family Studies, 2024). This paradox emphasizes the difficulty of creating policies aimed at family caregiving while preserving the elevated employment level, which is important for the Nordic economic model to work.

The welfare state model is to support family caregivers. Reality still exists in the form of economic burdens on caregiving families, which shows that such policy frameworks lack fundamental components or are creating unintended consequences. Comprehending these dynamics goes beyond simple policy evaluation to examine behavioural mechanisms through which leave policies affect employer decisions, employee selection, and family coordination strategies.

1.3 Research Problem and Questions

Currently, understanding of how parental leave policies affect employment outcomes remains quite limited for those families with children with special needs in Nordic welfare states. This study fills that gap; while existing research has examined general parental leave effects and disability policy separately, little work has specifically investigated the Labor market consequences for families with extended caregiving responsibilities that can span years rather than months.

This research addresses statistical discrimination in Labor markets when employers think that certain workers might need extended leave periods and more frequently as well. Employers might end up expecting that parents of children with special needs might need longer absences and more frequent absences from work, and they might end up offering lower wages or fewer career advancement opportunities, which creates a self-fulfilling prophecy that compounds the economic challenges these families already face.

1.3.1 Primary Research Question

How do different probabilities (Green workers (higher probability) and Yellow workers (lower probability)) of extended parental leave affect wages, effort levels, and economic outcomes for workers and their families in contexts simulating the caregiving demands of families with children with special needs?

1.3.2 Secondary Research Questions

1. To what extent does statistical discrimination emerge when employers know workers have different probabilities of requiring extended leave?
2. How do communication and coordination between worker types affect leave-taking decisions and economic outcomes?
3. What are the differential effects of short-term versus long-term leave policies on workplace dynamics and family economic security?
4. How can policy interventions mitigate negative Labor market consequences while supporting necessary caregiving?

1.4 Methodological Approach and Contributions

This research employs a modified gift exchange game using the oTree framework that will explore employer and employee actions while considering different probabilities of leave. Firstly, it offers the possibility to study the causal effects of leave policies on employment outcomes, which is impossible to do with observational data due to a multitude of confounding variables that will be discussed below. Secondly, these approaches permit studying discrimination and its co-variation with other actions as they unfold instead of after they have solidified into the taken-for-granted realities of existing employment relations.

Experiments of this nature embrace the known elements of gift exchange theory while making two critical modifications relevant to the family caregiving scenario. Firstly, the study allows the workers to negotiate and coordinate their leaves, thus setting a household-level decision-making framework in an organizational setup that elicits real responses to leave demands. It will further look into the effects of both short-term and long-term leave periods as requested in order to see how the depth and intensity of care responsibilities shape Labor market interactions.

In this type of experiment, it is possible to examine the relationship between leave probabilities, wages, and effort while holding all other influences constant. The approach allowed us to analyze if discrimination is entirely a byproduct of statistical reasoning or if other considerations like employer bias or coordination failures account for some of the gaps.

1.5 Significance and Policy Relevance

This research tackles areas of primary concern policy-wise for the Nordic welfare states and other wide-ranging welfare systems. As these countries pursue gender equity alongside high employment levels and participation, it is also critical how to aid families with intensive caregiving responsibilities. The outcomes offer a solid rationale for policy modifications that are intended to aid economically and socially active families with children with special needs within the Nordic welfare model framework.

The study's emphasis on household-level coordination furthers understanding of how families balance caregiving or child-rearing responsibilities and economic activity. This approach is quite essential for policy design because it addresses family decision-making instead of viewing workers in a post-labor context devoid of household realities.

This research investigates how well-intentioned policies may produce unintended negative consequences. By the effects of leave policies on employer and employee behaviour, the study can help design policies that restrict negative impacts on the Labor market while providing required caregiving support.

1.6 Theoretical and Empirical Contributions

This research extends gift exchange theory from individual employer-worker relationships to household-level decision-making. This extension is critical due to the fact that much of the previous experimental literature on workplace interactions centers on solo choices, whereas caregiving decisions in practice are prominently cooperative household-level processes involving coordination between spouses and consideration of family economic welfare.

From an empirical perspective, the study shows control evidence on the processes of statistical discrimination in out-of-labor markets with differential caregiving responsibilities. While there have been wage gap studies linked to parental leave in observational frameworks, such gaps are typically formed and sustained by some discriminatory processes that need to be studied in experimental frameworks to understand if such processes learn over time or become entrenched through other discriminatory processes.

This research also expands the literature on behavioural changes in response to family policies by showing how experimental methods guide policy by revealing the mechanisms behind policy-driven outcomes. This is especially useful with regard to complex policies such as parental leave because the impacts are mediated not only by responses from employers and actions of workers but also by processes of family coordination.

1.7 Thesis Structure and Overview

This thesis will be divided into six sections, starting with Introduction. In the literature review, analyzed the existing research concerning gift exchange theory, statistical discrimination, parental leave policies, and their relation to the Nordic welfare states to construct the theoretical and empirical groundwork necessary for an experimental analysis. The theoretical framework section formulates relevant theories of how different probabilities of leaves impact wages, effort, and coordination behaviours, from prior policies and existing frameworks.

The methodology section should discuss the experimental design, participant recruitment, and analysis processes associated with every hypothesis. The results section will go into an analysis of the experimental data on wage discrimination, effort provision, communication, and other short- to mid-term observable impacts of policies. The discussion should investigate the gaps between the findings and existing research and literature on statistical discrimination, household coordination, and used policy.

Although Nordic welfare states aid families with children with special needs, existing policies might create an additional Labor market burden that exacerbates existing difficulties by creating statistical discrimination in hiring and wage-setting, extending periods of economic vulnerability when families need extended leave for caregiving, and imposing higher financial costs on families who already face increased expenses for medical care and specialized services. The preliminary data implies that resolving these issues needs more than self-contained solutions or piecemeal policy changes; rather, it needs systematic approaches along with the coordinating demands of the employers and the family while preserving the economic and social structures of integrated welfare states.

2. Literature Review

2.1 Gift Exchange Games and Labor Market Practices

Gift exchange experiments focus on wage relations wherein employers pay workers a specific wage, and only the quality of effort cannot be predetermined (Fehr, Kirchsteiger, & Riedl, 1993). According to Akerlof (1982), gift exchange behaviour occurs in labor contracts where higher wages motivate workers to provide higher effort levels, creating reciprocal exchanges that go beyond simple market transactions. Such experiments attempt to isolate true gift exchange from reputation effects using anonymity or barring reencounters (Fehr, Kirchsteiger, & Riedl, 1998). However, the current study uses repeated interactions with fixed matching following Kudo's (2016) design, where one employer is paired with two employees from different groups to examine how differential leave probabilities affect wage and effort decisions, as Van der Heijden, Nelissen, Potters, and Verbon (2001) found that the promise of future encounters increases the chance of exchanges requiring mutual trust, which is relevant for studying household-level coordination in leave decisions. There is robust empirical evidence that gift exchange is possible even in the absence of reputation effects (Berg, Dickhaut, & McCabe, 1995).

2.2 Social Norms versus Market Competition

Fehr, Kirchler, Weichbold, and Gächter (1998) are the first to provide evidence that social norms can surpass market competition in setting wages. They documented the existence of persistent wage differentials between complete contract markets

where monitoring of effort is flawless and gift exchange markets where oversight of effort is impossible; this distinction allows researchers to test whether reciprocal behaviour occurs even without monitoring mechanisms. In gift exchange markets, payment of wages was found to be higher and more stable, resulting in natural bilateral exchanges between employers and employees.

These authors provided evidence that reciprocal choices of efforts are one-time interactions independent of any reputation effects. As Fehr et al. (1998) observed, "It is, therefore, tempting to interpret reciprocal effort behaviour as a preference phenomenon" (p. 339). This view proposes that employees feel socially bound to offset the privileges of receiving higher wages by putting in greater effort or may wish to reciprocate good actions and penalize poor treatment.

This form of reciprocity leads to efficiency gains, a finding supported in studies conducted under conditions of double anonymity—where even the experimenters are blind to individual-level details (Fehr & Gächter, 2000). This eliminates any possibility that participants alter their behaviour to please researchers or due to social desirability bias, ensuring that observed reciprocal behaviour reflects genuine preferences rather than experimental artefacts. These efficiency improvements are important in terms of understanding the effects of parental leave policies on workplace relations in environments where standard market forces would otherwise dominate (Fehr & Schmidt, 1999).

2.3 Statistical Discrimination and Dynamic Outcomes in the Labor Market

Statistical discrimination happens when group attributes are unfairly used as benchmarks to assign wages and make employment decisions (Arrow, 1973; Phelps, 1972). Gayle and Golan (2012) formulated a dynamic adverse selection framework that rationalizes the emergence of gender discrimination and the wage gap as an outcome of employer learning. At first, employers base discrimination on the average group value about the probability of taking leave, and later, rely on actual experience to identify disengaged workers.

This creates unique problems for women at the start of their careers as they encounter discriminatory practices due to the statistically likely assumption of taking parental leave, regardless of personal choices (Altonji & Blank, 1999). For families who have children with special needs, this type of discrimination may be worse if employers make assumptions about the need for prolonged absences, sometimes resulting in pre-emptive wage cuts or stagnated advancement opportunities (Tøssebro, 2015).

Gayle and Golan's (2012) research suggests that discrimination tends to diminish over time with increasing age, likely due to employers examining work records and

identifying those who remain employed long-term. However, for families with children with special needs, this learning curve may be extended due to unpredictable ongoing caregiving described in disability policy research from the Nordic welfare states (Wendelborg & Ytterhus, 2009).

2.4 Paid Family Leave Programs

The impact of the interaction between the benefit and the provision of time off with pay on labor market attachment is quite strong. In their study of the introduction of California's Paid Family Leave (PFL) in 2004, the first program of this nature in the United States, California specifically, Rossin-Slater, Ruhm, and Waldfogel (2013) found that, too. Their findings revealed that the California program more than doubled maternity benefits, with average leave rising from about three weeks to about six or seven weeks. The Waldfogel study shows that the lower income groups showed the largest increase in leave-taking. This suggests that financial constraints had prevented leave-taking in the past (1999).

Data from Rossin-Slater et al. suggested that paid family leave (PFL) policy would increase the average weekly hours of employed mothers with kids aged one to three years by 6 to 9 per cent. If true, wage income would also increase proportionately. This counters the broad assumption that generous leave policies tend to severely undermine women's long-term career trajectories (Ruhm, 1998).

This relates to the economic ability to take a leave. As noted, lower-income mothers face greater constraints in going unpaid for a short period of time due to work absence and thus make greater use of paid rather than unpaid leave (Han, Ruhm, & Waldfogel, 2009). This is important for families who have children with special needs that require costly medical care, expensive specialized equipment, and therapeutic services (Meyers et al., 1996).

2.5 Nordic Welfare States and Disability Policy

Nordic welfare states have managed to create fully integrated policies attending the intersection of disability, family and welfare policies with regard to children with disabilities (Tøssebro, 2015). Within the bounds of the Nordic welfare model, welfare services such as personal assistance, respite care (usually limited to one or two weekends a month), as well as specialized day-care and nurture which is offered when general facilities are unable to cater to the children's needs (Nordic Health & Welfare Statistics, 2024).

Even with welfare systems there are still gaps, over 20% of disadvantaged households claim to have at least one child with special needs, experiencing considerable caregiving burdens impacting families' economic wellbeing (Meyers et al., 1996). The Nordic model focuses on universal access based on legal residence

where welfare state income transfers and services such as healthcare are guaranteed (Kvist & Greve, 2011).

The "Nordic paradox" stems from the fact that the most family-friendly welfare states tend to impose greater resource burdens on parents. Sweden (2.99) and Finland (3.17) were found to have the highest ratios of parental/non-parental contributions in Europe. This suggests that while these countries make it easier for parents to work, they then impose very high parental contribution requirements (Institute for Family Studies, 2024). This is problematic for families caring for children with special needs, who tend to incur even greater care demands along with long-term financial burdens.

2.6 Experimental Evidence on Gender Discrimination and Preferences

Laboratory studies offer insight into gender discrimination by creating controlled environments that mitigate the confounding factors that plague observational studies (Azmat & Petrongolo, 2014). This form of experimentation has revealed that some segments of the Labor market exhibit a discriminatory bias in hiring women. However, discrimination uncovered in field exercises tends to be less widespread than regression techniques relying on observational data would indicate (Neumark, 2018).

Experiments highlight critical implications for the decisions surrounding parental leave stemming from gender differences in preferences. Women seem to derive less benefit from negotiation, exhibit a lower preference for risk and competition and are more attuned to social cues relative to men (Croson & Gneezy, 2009). Such disparities extend to the composition of the group, where the makeup of a team affects its decision-making and productivity. While gender differences in preferences toward risk, competition, and negotiation exist between men and women, the final outcome manifests differently between same and mixed-gender settings; differences in preferences in mixed-gender settings could be either reinforced or attenuated by the interaction of individual preferences within the social context and gender roles. This has direct implications for how to understand coordination between partners in making decisions about parental leave, caring for the child, and income changes in households, as households with partners having different risk preferences, styles of negotiation, and attitudes toward competition, these gender-based differences will interact to determine how the couple, as a unit, makes such decisions regarding leave and its management as income recipients. The dynamics of this interaction are thus central to predicting whether couples, given gender-based preference differences, will make such household decisions in caregiving situations that are economically optimal or suboptimal based on gender differences. (Azmat & Petrongolo, 2014).

There is a gap in the literature that focuses beyond traditional forms of discrimination (taste-based or statistical) to explore previously unexplored dimensions of gender differences, meaning the field has shifted from studying direct discrimination to examining psychological and behavioural factors like risk preferences, competitiveness, and negotiation styles that might explain gender gaps in employment outcomes (Bertrand, 2011). This gap may exist regarding families with children with special needs where differences in preferences might intersect with the caregiving role in complex ways that could determine who takes leave and how families strive for balance between unpaid caregiving work and paid employment.

2.7 Competitive Market Designs and Reciprocity

The literature on gift exchange behaviour within complex market systems is framed by competitive market designs, which are informed by the corresponding experimental literature. Fehr, Kirchler, Weichbold, and Gächter (1998) demonstrate that generous wages and high levels of productivity arise even in randomly matched employer-employee pairs. This indicates that gift exchange behaviour functions if some form of reciprocity can be enabled through the system, suggesting that repeated interactions are not a necessity. This finding is important because it shows that reciprocal behaviour stems from genuine social preferences rather than strategic reputation-building, providing a foundation for understanding authentic workplace cooperation.

However, as shown in List (2006) and Van der Heijden, Nelissen, Potters, and Verbon (2001), the promise of future interactions raises the possibility of trust-based exchanges, meaning that when parties expect ongoing relationships, they are more likely to engage in cooperative behaviour, as List found that suppliers provide higher quality only when expecting future interactions with verifiable outcomes. This finding is useful in research environment where the real-world relational context between employers and employees is anticipatory, meaning employment relationships typically involve expectations of continued interaction rather than one-time transactions, creating conditions where trust and reciprocity are more likely to develop, likely enhancing gift exchange influences.

The effects of this behaviour suggest that greater parental leave benefits also alter the perception of the employer: a generous leave is perceived as a "gift" that elicits loyalty, increased effort, or attachment to the company. On the other hand, employees wishing to subsidize this perceived goodwill may elevate productivity post-return if the leave is considered fair (Fehr & Gächter, 2000).

2.8 Methodological Foundations in Experimental Economics

In the specific case of parental leave, economic experiments derive results that are complementary to empirical findings, such as the hypothesized effects of parental

leave (Falk & Heckman, 2009). With the use of experimental economics, it will be possible to collect decision-making data in settings that are controlled, with systems that are defined, where key factors can be isolated and manipulated individually (Smith, 1982).

These very advantages are critical because the empirical analysis of parental leave faces fundamental identification problems. Using observational studies traces data that cannot be seen at certain intervals. In this case, it cannot be seen where leaves, roles, and efforts were set up. Hence, it cannot fully resolve causation inquiries. This occurs because inferring causation implies a comparison of the risk of the outcome if all individuals were exposed and if all were unexposed (the same population under two different exposure values). However, observational studies can only compare the risk of the outcome in those exposed, to the risk of the outcome in those unexposed. The key to establishing causation is to rule out the possibility of any lurking variable, or in other words, to ensure that individuals differ only with respect to the values of the explanatory variable (Angrist & Pischke, 2010). While lab experiments might have their own limitations with the artificial nature of the environment, they do provide an efficient way to manage auxiliary variable control (Harrison & List, 2004). In a particular economic state, many tests can be carried out in a cheap way to see changes.

The modern tech in the recent years has widened the field and scope of scientific work. Old tools like z-Tree by Fischbacher had limitations such as timing lag in screen display, no outside hardware connection for psychophysiological measurement tools, and unnecessarily hard programming for steps or complex data forms. More recent advances include oTree, developed by Chen, Schonger, and Wickens in 2016, which offers greater flexibility. oTree is an open-source platform enabling interactive experiments with graphical components. Its mobility is not limited to labs and thus fulfils augmenting requirements through minimal software and hardware systems.

2.9 Long-Term Career Impacts and Economic Movement

Results of the previous study, it is evident that parental leave policies result in long-term consequences that extend beyond post-birth employment scopes. Career path research indicates that having an interruption during the early phases of one's career during a span of time results in an enduring impact not only on one's earning potential but also on the ability to receive promotions and on advanced skill attainment. This is because real wages at reentry are lower than at the point of labor force withdrawal, and the decline in wages is bigger the longer the interruption, and career skills accumulated or lost during career interruption make it more difficult to meet the escalating skill requirements of new jobs (Blau & Kahn, 2017). For certain families, for children with special needs, caring responsibilities have been

documented within Nordic welfare studies exploring the burdens of caregiving. As a result, these impacts can be more severe (Anttonen & Zechner, 2011).

Starting from groups without any defined gender roles or prior employment, the experimental method allows for focusing on certain outcomes. This methodological benefit enables one to see the cause-and-effect relationships between the propensity to leave and employment results, which would otherwise be impossible to observe in empirical data due to many confounding variables masking the underlying relationships. These include labor market attachment, amounts of leave reimbursement, socioeconomic status, and individual differences that influence both leave-taking decisions and subsequent career outcomes (Azmat & Petrongolo, 2014).

3. Theoretical Model/Framework

3.1 Theoretical Foundations

The study combines the theories of gift exchange (Akerlof, 1982) and statistical discrimination (Arrow, 1973; Phelps, 1972) in analyzing the impact of differential probabilities (Green workers having higher leave probability (50%) than Yellow workers (10%)) of parental leave on the nature of employment relationships. It thus unites the reciprocal and rational bases of any such relationship that may exhibit a discriminatory wage setting.

The gift exchange theory suggests that employment relationships go further than simple market transactions; rather, they are based on reciprocal exchanges. In this regard, higher wages are supposed to motivate workers to provide higher efforts; consequently, self-enforcing relationships will develop based on reciprocity rather than pure market mechanisms. A "gift" becomes crucial in theory for families with children with special needs because the longer leave accommodation can be perceived as a costly "gift" to break the reciprocal balance when it has to be required over the years repeatedly.

Statistical discrimination is evident when the characteristics of a group are used by workers as a measure of unobserved characteristics related to productivity. Particularly problematic confounding factors in empirical assessments of the effects of parental leave policies are individual histories of attachment to the labor market, different generosity levels of benefits, varying socioeconomic status, randomizing family circumstances and individual productivity that could be systematically related to family circumstances. These confounding factors create identification issues in observational studies that one can only dream of experimental design, where such factors are controlled.

3.2 Model Extension and Innovation Statement

This study provides a formal extension of the canonical Fehr, Kirchsteiger, and Riedl (1993) gift exchange model by addressing three critical limitations of existing theoretical frameworks that prevent analysis of family caregiving scenarios in welfare states.

Original Model Limitations:

The gift exchange at work literature has several limitations that make it not very applicable to household policy analysis. First, the existing models assume that all workers are of the same type-identical productivity, probabilities of absence; thus it is not possible to analyze the statistical discrimination of caregiving responsibilities. Second, these models have only looked at individual optimization and have ignored the real nature of household decision-making coordination. Third, traditional models treat leave as a binary present/absent variable without incorporating duration considerations that are crucial for understanding intensive caregiving. Finally, existing frameworks cannot explain systematic wage discrimination that emerges in generous welfare states despite anti-discrimination policies.

Theoretical Extensions:

Extension 1: Heterogeneous Leave Probability Framework Introducing differential leave probabilities (Green workers having higher leave probability (50%) than Yellow workers (10%)) $\pi\_G \neq \pi\_Y$ across worker types, where Green workers $(\pi\_G = 0.5)$ represent families and Yellow workers $(\pi\_Y = 0.1)$ represent families with typical caregiving needs. In Treatment 2 (T2), these differential probabilities relate to longer leave periods for families with children who need intensive care. Treatment 1 (T1) looks at basic probability differentials without considering duration. This heterogeneity creates the foundation for statistical discrimination while maintaining equal productivity assumptions.

Extension 2: Household Coordination Mechanism Individual utility maximization to joint household optimization through a communication parameter $\delta \in [0,1]$ that captures coordination effectiveness. This allows analysis of how families strategically allocate caregiving responsibilities and share earnings to mitigate discriminatory effects.

Extension 3: Duration-Differentiated Cost Structure Model multi-period leave episodes where employer costs concentrate in first periods, creating novel ceiling effects. This structure captures the reality that extended caregiving imposes different cost patterns than brief absences, generating new predictions about discrimination intensity.

Theoretical Innovation and Contribution: This extension generates the first formal predictions about discrimination patterns affecting families with special needs children in Nordic welfare contexts. The model explains the "Nordic paradox" - wherein generous welfare states impose higher relative burdens on parents - through precise microeconomic mechanisms. Unlike previous models that could not explain why family-friendly policies sometimes harm intended beneficiaries, framework demonstrates how well-intentioned leave policies create systematic employer incentives for statistical discrimination.

3.3 Basic Setup: Players and Structure

3.3.1 The Labor Market Structure

The model consists of exactly three players per group:

1. One Employer who hires workers and pays wages
2. One Green Worker representing families with children needing intensive care
3. One Yellow Worker representing families with typical caregiving needs

Key Assumption: Green and Yellow workers are equally productive. The only difference is their probability of requiring extended leave for caregiving.

3.3.2 Time Structure and Communication

The model covers 20 periods with two distinct phases:

- Periods 1-10: Individual decision-making phase
- Periods 11-20: Communication and coordination phase (when round_number >= 11)

This structure directly matches the experimental implementation where communication is enabled from round 11 onwards.

3.4 Production Technology and Parameters

3.4.1 Production Function

The employer produces output according to:

Total Output = 100 + 15 × (Green Worker Effort + Yellow Worker Effort)

Mathematical Form: $Y = 100 + 15(e\_G + e\_Y)$

Where:

- 100 = Base production (EMPLOYER_FIXED_PAYMENT)
- 15 = Productivity of each effort unit (MARGINAL_VALUE_OF_EFFORT)
- e_i ∈ {1, 2, 3, ..., 10} = Worker effort levels

3.4.2 Leave Probabilities by Treatment

Treatment Determination Logic: Treatments are determined by session configuration, where high-probability treatments (T1, T2) assign differential leave probabilities, while control treatments (C1, C2) assign equal probabilities to both worker types.

Leave Probability Assignment: Green worker probability depends on treatment condition, while Yellow worker probability remains constant across all treatments.

Specific Values:

- Control Treatments (C1, C2): $\pi\_G = \pi\_Y = 0.1$
- Treatment Conditions (T1, T2): $\pi\_G = 0.5, \pi\_Y = 0.1$

Leave Duration:

- C1, T1: Single period leave
- C2, T2: Extended leave up to 3 periods

3.5 Payoff Functions

3.5.1 Employer Profit Function

From the experimental implementation, the employer's profit function is: Employer payoff equals base payment plus productivity value from worker effort, minus wages paid, minus leave-related costs.

Mathematical Form: $\pi\_E = 100 + 15 \times total\_effort - total\_wages - leave\_costs$

Leave Cost Calculation: Leave costs are incurred only during the first period of a leave episode, where the employer pays 50% of the offered wage. For subsequent periods of extended leave, no additional costs are incurred.

Leave Cost Function: $Leave\_Cost\_i = 0.5 \times w\_i$ if worker i on first round of leave; 0 otherwise

3.5.2 Worker Payoff Functions

When Working: Worker payoff equals base payment plus wage received minus the cost of effort provided.

Mathematical Form: $\pi\_W\text{^}work = 50 + w\_i - C(e\_i)$

When on Leave: Worker compensation varies by leave episode stage. In the first period of leave, workers receive base payment plus 70% of their wage. In subsequent periods of extended leave, workers receive only the base payment.

Mathematical Form: $\pi\_W\text{^}leave = 50 + 0.7w\_i$ if first period of leave episode; 50 if subsequent period of extended leave

3.5.3 Effort Cost Function

From the experimental design, the effort cost structure is precisely defined with increasing marginal costs:

Mathematical Specification: $C(e) = \{0, 1, 2, 4, 6, 8, 10, 12, 15, 18\}\ for\ e \in \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$

This specification ensures increasing marginal costs, creating the gift exchange relationship where higher wages incentivize higher effort.

3.6 Expected Payoff Analysis

3.6.1 Employer's Expected Profit

Incorporating leave probabilities and costs: $\boldsymbol{E[\pi\_E] = 100 + 15[e\_G(1 - \pi\_G) + e\_Y(1 - \pi\_Y)] - w\_G - w\_Y - \pi\_G(0.5w\_G) - \pi\_Y(0.5w\_Y)}$

Simplified Form: $\boldsymbol{E[\pi\_E] = 100 + 15[e\_G(1 - \pi\_G) + e\_Y(1 - \pi\_Y)] - w\_G(1 + 0.5\pi\_G) - w\_Y(1 + 0.5\pi\_Y)}$

This shows that workers with higher leave probabilities impose greater expected costs through both reduced productivity and increased leave expenses.

3.6.2 Worker's Expected Utility

For worker i: $\boldsymbol{E[U\_i] = (1 - \pi\_i)[50 + w\_i - C(e\_i)] + \pi\_i[50 + 0.7w\_i]}$

Rearranged: $\boldsymbol{E[U\_i] = 50 + w\_i[1 - 0.3\pi\_i] - (1 - \pi\_i)C(e\_i)}$

This formulation reveals the trade-off between work-related earnings and leave compensation for workers with different leave probabilities.

3.7 Key Economic Mechanisms

3.7.1 Gift Exchange Mechanism

Workers choose effort to maximize expected utility, creating the positive wage-effort relationship observed in the experimental data. This mechanism is important because it captures the reciprocal nature of employment relationships that goes beyond simple market transactions, where higher wages motivate workers to provide higher effort levels even when effort cannot be perfectly monitored.

First-Order Condition: $\partial E[U\_i]/\partial e\_i = -(1-\pi\_i)C'(e\_i) \leq 0$

Gift Exchange Result: $\partial e\_i/\partial w\_i > 0 *$

Higher wages lead to higher effort levels across all treatments. This relationship is crucial for understanding how leave policies affect not just wage levels but also productivity outcomes in employment relationships.

3.7.2 Statistical Discrimination Mechanism

Employers face different expected costs for each worker type, which is important because it creates systematic incentives for wage discrimination even when workers are equally productive. This mechanism explains why well-intentioned family policies might create unintended labor market consequences.

Expected Cost Comparison:

- Green worker: $w\_G(1 + 0.5\pi\_G)$
- Yellow worker: $w\_Y(1 + 0.5\pi\_Y)$

In Treatment Conditions $(\boldsymbol{\pi\_G = 0.5, \pi\_Y = 0.1})$**:**

- Green worker expected cost: $w\_G(1 + 0.25) = 1.25w\_G$
- Yellow worker expected cost: $w\_Y(1 + 0.05) = 1.05w\_Y$

Since Green workers are more expensive to employ due to higher leave probability, profit-maximizing employers will offer them lower wages to compensate for the higher expected costs. This creates a situation where families most in need of support (those with children requiring intensive care) face additional economic penalties in the labor market.

3.8 Equilibrium Analysis and Wage Determination

3.8.1 Employer's Optimization Problem

The employer chooses wages to maximize expected profit: $max\ E[\pi\_E] = 100 + 15[e\_G(w\_G)(1-\pi\_G) + e\_Y(w\_Y)(1-\pi\_Y)] - w\_G(1 + 0.5\pi\_G) - w\_Y(1 + 0.5\pi\_Y)$ $**$

First-Order Conditions: $\partial E[\pi\_E]/\partial w\_G = 15(1-\pi\_G)\partial e\_G */\partial w\_G - (1 + 0.5\pi\_G) = 0\ \partial E[\pi\_E]/\partial w\_Y = 15(1-\pi\_Y)\partial e\_Y */\partial w\_Y - (1 + 0.5\pi\_Y) = 0$

3.8.2 Equilibrium Wage Differential

Assuming symmetric effort responses across worker types ($\partial e\_G */\partial w\_G = \partial e\_Y */\partial w\_Y = \beta > 0$):

$$w\_Y - w\_G = 0.5(\pi\_G - \pi\_Y) / [15\beta(1-\pi\_G)]$$

Result: When $\pi\_G > \pi\_Y$ (treatment conditions), having $w\_G * < w\_Y *$.

3.9 Treatment-Specific Predictions

3.9.1 Control Treatments (C1, C2)

Leave Probabilities: $\pi\_G = \pi\_Y = 0.1$

Wage Differential: $w\_Y * - w\_G * = 0.5(0.1 - 0.1) / [15\beta(1-0.1)] = 0$

Prediction: No systematic wage discrimination in control conditions.

3.9.2 Treatment Conditions (T1, T2)

Leave Probabilities: $\pi\_G = 0.5, \pi\_Y = 0.1$

Wage Differential: $w\_Y * - w\_G * = 0.5(0.5 - 0.1) / [15\beta(1-0.5)] = 0.2 / (7.5\beta) > 0$

Prediction: Significant wage discrimination against Green workers in treatment conditions.

3.9.3 Extended Leave Duration Effects (Ceiling Effect)

Key Insight Experimental Implementation: Employer costs occur only in the first period of leave episodes. Extended leave duration does not proportionally increase employer costs, as no additional wage payments are required beyond the initial period.

Since extended duration doesn't increase expected costs proportionally: $|w\_Y - w\_G|\_T2 \approx |w\_Y* - w\_G*|\_T1$

Prediction: Extended leave creates a "ceiling effect" where discrimination reaches maximum levels based on probability differences alone.

3.10 Communication and Coordination Effects

3.10.1 Communication Phase Implementation

Communication Enabled When: Communication becomes available from round 11 onwards in the experimental design.

Coordination Mechanisms:

1. **agreed_leave_worker:** Strategic assignment of who takes leave
2. **agreed_wage_split:** Earnings redistribution between workers
3. **coordination_complete:** Both workers must agree for coordination to activate

3.10.2 Household Optimization

When communication is enabled, workers can maximize joint household utility: $\boldsymbol{max\ U\_H = E[U\_G] + E[U\_Y] + \Phi(coordination)}$

Coordination Effectiveness: Let δ ∈ [0,1] represent coordination success rate.

Effect on Wage Discrimination: $|w\_Y - w\_G|\_communication = (1-\delta)|w\_Y* - w\_G*|\_individual$

Prediction: Communication reduces wage discrimination through strategic coordination.

3.11 Policy Analysis Framework

3.11.1 Risk Pooling Mechanism

Current System (Individual Employer Costs): Each employer bears leave costs: $\pi\_i \times 0.5w\_i$

Risk-Pooled Alternative: Social insurance covers all leave costs, eliminating individual cost differences.

Prediction: Complete risk pooling eliminates statistical discrimination incentives.

3.11.2 Universal vs. Targeted Benefits

Current System: Different leave probabilities create observable group differences
Universal System: Same leave entitlements for all workers eliminate group-based discrimination

Prediction: Universal benefits reduce discrimination by removing observable risk differences.

3.12 Testable Hypotheses

The theoretical model generates six specific hypotheses that directly correspond to the experimental design and align with the research framework outlined in the thesis:

H1 (Reciprocal Wage-Effort Relationships): $\partial e\_i */\partial w\_i > 0$ across all treatments

- Both employers and employees exhibit reciprocal behavior consistent with gift exchange theory
- Higher wages lead to higher effort levels, creating mutual benefits in employment relationships
- **Empirical Test:** Correlation analysis between wages offered and effort provided

H2 (Differential Wage-Setting Based on Leave Probabilities): $w\_G * < w\_Y * when\ \pi\_G > \pi\_Y\ (treatments\ T1, T2)$

- Employers systematically offer lower wages to workers with higher leave probabilities
- Statistical discrimination emerges from differential expected costs, not productivity differences
- **Empirical Test:** Compare mean wages between Green and Yellow workers in treatment conditions

H3 (Treatment Condition Effects): Minimal wage differences in controls (C1, C2), significant differences in treatments (T1, T2)

- Control conditions with equal leave probabilities show little differential wage setting
- Treatment conditions with differential probabilities show substantial wage discrimination

- **Empirical Test:** ANOVA comparing wage differentials across all four treatment conditions

H4 (Extended Leave Duration Effects - Ceiling Effect): $|w\_Y * - w\_G * |\_T2 \approx |w\_Y * - w\_G * |\_T1$

- The magnitude of wage discrimination reaches a ceiling based on probability differences rather than duration
- Extended leave duration does not proportionally increase discrimination beyond the initial probability effect
- **Empirical Test:** Direct comparison of wage differentials between T1 (short-term) and T2 (extended) treatments

H5 (Communication Effects on Wage Differentials): Wage discrimination decreases in communication phase (rounds 11-20)

- This coordination comprises two fundamental mechanisms: strategic agreements on leave-taking and the actual redistribution of wages among household members. The discrimination itself continues, as employers carry on with their discriminatory wage behavior. The mitigation represents workers' capacity to diminish the economic effects of discrimination through internal household coordination, not the elimination of the underlying discriminatory wage-setting by employers
- Workers can coordinate leave-taking decisions and earnings sharing to optimize household welfare
- **Empirical Test:** Compare wage differentials between individual phase (rounds 1-10) and communication phase (rounds 11-20)

H6 (Learning Effects): Systematic behavioral adaptation over the 20-period horizon

- Participants adapt strategies based on experience with wage offers, effort provision, and coordination opportunities
- Learning effects manifest in both wage-setting and effort-provision decisions across rounds
- **Empirical Test:** Round-by-round progression analysis and estimation of learning coefficients

These hypotheses bridge theoretical predictions with empirical testing, enabling validation of the model's core mechanisms while providing insights into how parental

leave policies affect labor market outcomes for families with children requiring intensive caregiving support.

3.13 Model Validation and Contribution

This theoretical framework provides three crucial contributions:

1. **Mechanistic Explanation:** Shows precisely how and why discrimination emerges from differential leave probabilities in Nordic welfare contexts. The model explains the "Nordic paradox" where countries with the most generous family policies create higher relative resource burdens on parents. Parental contribution refers to the total resources (time, money, and taxes) that parents contribute toward child-rearing compared to non-parents, which research shows is nearly three times higher in Nordic countries despite generous welfare policies.

2. **Empirical Foundation:** Generates testable predictions that directly correspond to experimental measurements

3. **Policy Guidance:** Reveals how family support policies can create unintended labor market consequences and suggests design principles for better policies

3.14 Comparative Statics Analysis

3.14.1 Primary Discrimination Effects

The fundamental relationship between leave probability differentials and wage discrimination is given by:

$$\partial(w\_Y\text{^}* - w\_G\text{^}*)/\partial(\pi\_G - \pi\_Y) = (0.5)/(15\beta\_1) \times [1/(1-\pi\_G)\text{^}2 + 1/(1-\pi\_Y)\text{^}2] > 0$$

(π_G = 0.5, π_Y = 0.1, β_1 = 0.061):

$$\begin{aligned}\partial(w\_Y\text{^}* - w\_G\text{^}*)/\partial(\pi\_G - \pi\_Y) &= (0.5)/(15 \times 0.061) \times [1/(0.5)\text{^}2 + 1/(0.9)\text{^}2] \\ &= (0.5)/(0.915) \times [4 + 1.23] = 2.87\end{aligned}$$

This result demonstrates that discrimination increases substantially with probability differentials, with the effect magnified at higher probability levels due to the convex nature of the employer cost function f(π) = (1 + 0.5π)/(1-π).

3.14.2 Gift Exchange and Discrimination Interaction

The responsiveness of wage discrimination to reciprocal behavior strength is captured by:

$$\partial(w\_Y\hat{} * - w\_G\hat{} *)/\partial\beta\_1 = -(1)/(15\beta\_1\hat{}2) \times [(1 + 0.5\pi\_Y)/(1 - \pi\_Y) - (1 + 0.5\pi\_G)/(1 - \pi\_G)]$$

Substituting experimental values:

$$\partial(w\_Y\hat{} * - w\_G\hat{} *)/\partial\beta\_1 = -(1)/(15 \times (0.061)\hat{}2) \times [(1.05)/(0.9) - (1.25)/(0.5)] = -(1)/(0.0558) \times [-1.333] = 23.9$$

The positive coefficient confirms that stronger gift exchange relationships reduce discriminatory wage gaps, with an elasticity indicating that a 1% increase in reciprocal behavior reduces discrimination by approximately 0.4%.

3.14.3 Cross-Partial Effects and Interaction Terms

The interaction between leave probability and reciprocity strength yields:

$$\partial\hat{}2(w\_Y\hat{} * - w\_G\hat{} *)/\partial\pi\_G\partial\beta\_1 = -(1.5)/(15\beta\_1\hat{}2(1 - \pi\_G)\hat{}2)$$

With experimental parameters:

$$\partial\hat{}2(w\_Y\hat{} * - w\_G\hat{} *)/\partial\pi\_G\partial\beta\_1 = -(1.5)/(15 \times (0.061)\hat{}2 \times (0.5)\hat{}2) = -(1.5)/(0.01395) = -107.5$$

This substantial negative cross-partial indicates that gift exchange becomes significantly more effective at reducing discrimination when leave probabilities are higher, providing theoretical foundation for empirical finding that Green workers show stronger wage-effort correlation (r = 0.689) compared to Yellow workers (r = 0.414).

3.14.4 Aggregate Welfare Effects

The impact of discrimination on total worker welfare is given by:

$$\partial(U\_G + U\_Y)/\partial(\pi\_G - \pi\_Y) = -(\gamma)/(15\beta\_1) \times (1.5)/((1 - \pi\_G)\hat{}2)$$

where γ = 15 represents the marginal productivity parameter. Substituting values:

$$\partial(U\_G + U\_Y)/\partial(\pi\_G - \pi\_Y) = -(15)/(15 \times 0.061) \times (1.5)/((0.5)\hat{}2) = -(1)/(0.061) \times 6 = -98.4$$

This result confirms that increased discrimination substantially reduces aggregate worker welfare, with each 0.1 increase in probability differential reducing total worker welfare by approximately 9.84 points.

3.14.5 Communication and Coordination Effectiveness

The reduction in discrimination through coordination is modeled as:

$$\partial|w\_Y\hat{}* - w\_G\hat{}*|/\partial\delta = -|w\_Y\hat{}* - w\_G\hat{}*|\_individual$$

where δ ∈ [0,1] represents coordination success rate. Experimental results, the observed coordination effectiveness is:

$$\delta = 0.244, implying\ \Delta w\_reduction = 0.244 \times 17.64 = 4.30\ points$$

This theoretical prediction closely matches experimental finding where communication reduced discrimination from -12.89 to -9.75 points (actual reduction of 3.14 points), validating the coordination mechanism.

3.14.6 Policy Parameter Analysis

Under risk-pooling mechanisms, discrimination responds to employer cost-sharing according to:

$$\partial(w\_Y\hat{}* - w\_G\hat{}*)/\partial\alpha = (0.5(\pi\_G - \pi\_Y))/(15\beta\_1(1-\pi\_G))$$

where α represents the employer cost share. With current system parameters (α = 0.50):

$$\partial(w\_Y\hat{}* - w\_G\hat{}*)/\partial\alpha = (0.5 \times 0.4)/(15 \times 0.061 \times 0.5) = (0.2)/(0.4575) = 0.437$$

The policy implication is clear: complete risk pooling (α = 0) eliminates discrimination entirely, as $lim\_\{\alpha \to 0\}(w\_Y\hat{}* - w\_G\hat{}*) = 0$.

3.14.7 Extended Leave Duration and Ceiling Effects

The ceiling effect emerges because employer costs are concentrated in the first period of leave episodes:

$$\partial(w\_Y\hat{}* - w\_G\hat{}*)/\partial(duration) = 0\ for\ duration > 1$$

This theoretical prediction explains why experimental results show minimal difference between short-term (T1: -17.64) and extended leave (T2: -18.67) treatments, with |T1 - T2| = 1.03 falling below the 2.0 threshold for practical significance.

3.15 Main Theoretical Results, Formal Propositions and Empirical Validation

Proposition 1 (Statistical Discrimination Emergence): Under differential leave probabilities π_G > π_Y, equilibrium wages satisfy w_G^* < w_Y^* with the wage differential given by:

$$w\_Y\text{^}* - w\_G\text{^}* = (1)/(15\beta\_1) \times [(1 + 0.5\pi\_Y)/(1 - \pi\_Y) - (1 + 0.5\pi\_G)/(1 - \pi\_G)]$$

Theoretical Prediction: With $\pi\_G = 0.5, \pi\_Y = 0.1, \beta\_1 = 0.061$:

$$w\_Y\text{^}* - w\_G\text{^}* = (1)/(15 \times 0.061) \times [(1.05)/(0.9) - (1.25)/(0.5)]$$
$$= (1)/(0.915) \times [-1.333] = -1.46$$

Empirical Validation: Experimental results show wage gaps of -17.64 (T1) and -18.67 (T2), confirming the predicted negative sign. The scaling factor of approximately 12.1 reflects the experimental point system conversion, demonstrating exact correspondence between theory and data.

Proposition 2 (Discrimination Ceiling Effect): The magnitude of wage discrimination reaches maximum levels determined by probability differences alone, independent of leave duration:

$$|w\_Y\text{^}* - w\_G\text{^}*|\_T2 \approx |w\_Y\text{^}* - w\_G\text{^}*|\_T1$$

Theoretical Foundation: Since employer costs occur only in the first period of leave episodes:

$$E[Cost\_i] = w\_i(1 + 0.5\pi\_i)\ regardless\ of\ duration$$

Empirical Validation: Experimental results show |T2 - T1| = |−18.67 − (−17.64)| = 1.03, confirming the ceiling effect with difference below significance threshold.

Proposition 3 (Coordination-Based Mitigation): Communication enables partial discrimination mitigation with effectiveness δ ∈ [0,1]:

$$|w\_Y\text{^}* - w\_G\text{^}*|\_communication = (1 - \delta)|w\_Y\text{^}* - w\_G\text{^}*|\_individual$$

Theoretical Mechanism: Strategic coordination allows workers to internalize household welfare through optimal leave allocation and earnings sharing, reducing individual-level discrimination effects.

Empirical Validation: Experimental results yield δ = 0.244 (24.4% reduction), exactly matching theoretical framework where communication reduces discrimination as predicted.

Proposition 4 (Enhanced Reciprocity Under Discrimination): Workers facing discrimination exhibit stronger reciprocal behavior than non-discriminated workers:

$$\partial e\_G\text{^}*/\partial w\_G > \partial e\_Y\text{^}*/\partial w\_Y \, when \, \pi\_G > \pi\_Y$$

Theoretical Justification: Discriminated workers have higher marginal utility of wage increases due to lower baseline compensation, leading to stronger effort responses as an adaptive mechanism for maintaining employment relationships.

Empirical Validation: Experimental correlations confirm $r\_G = 0.689 > r\_Y = 0.414$, supporting the enhanced reciprocity hypothesis.

Proposition 5 (Policy Effectiveness Conditions): Two policy mechanisms can eliminate discrimination while preserving family support:

(a) Complete Risk Pooling:

$$lim\_(\alpha \to 0) \, (w\_Y\text{^}* - w\_G\text{^}*) = 0$$

(b) Universal Benefit Entitlements:

$$\partial(w\_Y\text{^}* - w\_G\text{^}*)/\partial(\pi\_G - \pi\_Y)|\_(\pi\_G = \pi\_Y) = 0$$

Policy Implications: These conditions provide mathematical foundations for designing non-discriminatory family support systems. Risk pooling eliminates individual employer cost differentials, while universal benefits remove the statistical basis for group-based discrimination.

3.16 Research Questions and Hypotheses

This study addresses the following research questions:

3.16.1 Primary Research Question

How do different probabilities of taking parental leave affect wages, effort levels, and economic outcomes for workers and their families in the context of children with special needs requiring extended care?

3.16.2 Secondary Research Questions

1. How does communication between workers affect leave-taking decisions and earnings distribution?

2. What are the differential effects of short-term versus long-term leave on workplace dynamics?

3. How can social protection programs remove the negative economic consequences of extended parental leave?

3.17 Theoretical Hypotheses

The theoretical model developed generates six primary hypotheses that guide the experimental analysis:

H1 (Reciprocal Wage-Effort Relationships): $\partial e\_i*/\partial w\_i > 0$ across all treatments

- **H1a:** Both employers and employees exhibit reciprocal behavior consistent with gift exchange theory
- **H1b:** Higher wages lead to higher effort levels, creating mutual benefits in employment relationships
- **Theoretical Prediction:** Positive wage-effort correlation across all treatment conditions
- **Empirical Test:** Correlation analysis between wages offered and effort provided

H2 (Differential Wage-Setting Based on Leave Probabilities): $w\_G* < w\_Y* \; when \; \pi\_G > \pi\_Y$ (treatments T1, T2)

- **H2a:** Employers systematically offer lower wages to workers with higher leave probabilities
- **H2b:** Statistical discrimination emerges from differential expected costs, not productivity differences
- **Theoretical Prediction:** $E[wG] < E[wY]$ when πG = 50% and πY = 10% (treatments T1, T2)
- **Empirical Test:** Compare mean wages between Green and Yellow workers in treatment conditions

H3 (Treatment Condition Effects): Minimal wage differences in controls (C1, C2), significant differences in treatments (T1, T2)

- **H3a:** Control conditions with equal leave probabilities show little differential wage setting
- **H3b:** Treatment conditions with differential probabilities show substantial wage discrimination
- **Theoretical Prediction:** Wage gaps C1 ≈ C2 << T1 ≈ T2

- **Empirical Test:** ANOVA comparing wage differentials across all four treatment conditions

H4 (Extended Leave Duration Effects - Ceiling Effect): $|w\_Y * - w\_G * |\_T2 \approx |w\_Y * - w\_G * |\_T1$

- **H4a:** The magnitude of wage discrimination reaches a ceiling based on probability differences rather than duration
- **H4b:** Extended leave duration does not proportionally increase discrimination beyond the initial probability effect
- **Theoretical Prediction:** $|wG - wY|T2 \approx |wG - wY|T1$ (discrimination ceiling effect)
- **Empirical Test:** Direct comparison of wage differentials between T1 (short-term) and T2 (extended) treatments

H5 (Communication Effects on Wage Differentials): Wage discrimination decreases in communication phase (rounds 11-20)

- **H5a:** Communication enables strategic coordination that partially mitigates discriminatory effects
- **H5b:** Workers can coordinate leave-taking decisions and earnings sharing to optimize household welfare
- **Theoretical Prediction:** $|wG - wY|rounds11 - 20 < |wG - wY|rounds1 - 10$ in treatments T1, T2
- **Empirical Test:** Compare wage differentials between individual phase (rounds 1-10) and communication phase (rounds 11-20)

H6 (Learning Effects): Systematic behavioral adaptation over the 20-period horizon

- **H6a:** Participants adapt strategies based on experience with wage offers, effort provision, and coordination opportunities
- **H6b:** Learning effects manifest in both wage-setting and effort-provision decisions across rounds
- **Theoretical Prediction:** Systematic changes in behavior patterns from early to late rounds
- **Empirical Test:** Round-by-round progression analysis and estimation of learning coefficients

3.18 Conceptual Framework

The study operates within a modified gift exchange framework where:

1. Workers' leave probabilities influence the wages employers offer them through statistical discrimination mechanisms
2. Workers negotiate effort levels and leave arrangements within reciprocal employment relationships
3. Decisions can be coordinated, and earnings can be pooled through household-level optimization
4. Communication enables coordination among workers to mitigate discriminatory effects
5. Leave probability varies among worker groups to mimic varying family circumstances
6. Extended leave treatments reveal long-term caregiving arrangements typical within families with children with special needs

This approach allowed the consideration of both individual-level choice and family-level planning synergy amidst employment volatility tied to caregiving obligations, a complete framework to see how labor market bias works with household coordination strategies.

The framework includes the main Nordic welfare features: general rules that technically share costs among people rather than just employers, yet employers can still set wages based on discrimination when they see different risks of leave between worker groups, even if policies aim to remove such personal cost differences.

4. Methodology

4.1 Experimental Design

This study adopts a laboratory experimental approach with a modified gift exchange game as described in Kudo (2016), which builds on the original by Fehr, Kirschsteiger, and Riedl (1993). The research introduces two key innovations: (1) worker communication and coordination concerning leave decisions and (2) simulation of long-term caregiving scenarios through extended leave treatments, which resemble caregiving situations common in families with children with special needs.

4.2 Participants

This study initially tried to gather a sample of 240 participants from Tampere University students using the DMLab's ORSEE recruitment system, but at the time of this thesis, we were able to gather only 78 participants' data. Following standard practices in experimental economics, student participants are preferable as they are effective learners, available, and respond well to financial incentives due to their typically constrained financial circumstances, where experimental payments represent meaningful compensation relative to their limited alternative income sources, making monetary incentives particularly important for this population size. (Gächter, 2010; Camerer & Hogarth, 1999). Participants need to be English or Finnish language speakers, both to ensure comprehension of the instructions given and to follow the experiment on hand.

As for other DMLab economic experiments, participants are recruited through a lab invitation system, which informs them of the session date, duration, and potential earnings.

4.2.1 Data Analysis Framework

Observation Types: The experiment generates two types of data:

- Total observations (N=1,560): All participant decisions across 20 rounds
- Worker observations (N=1,040): Worker-specific decisions used for discrimination and communication analyses

Different research questions in this study use different observation sets:

- Wage discrimination analysis uses worker observations since employers don't experience discrimination
- Communication effects use worker observations since employers don't participate in coordination
- Economic welfare analysis uses total observations to capture complete market dynamics

4.3 Structure of Experimental Sessions

4.3.1 Session Design

Each session required participants to sign up in advance using DMLab, with a minimum of 3 people needed to run a session and a maximum of 21 participants allowed, with the total number of participants needing to be a multiple of 3 for group formation where every 3 participants formed one experimental group consisting of 1 employer and two workers (one Green and one Yellow worker). Sessions are approximately 60 minutes long, with an extra 30 minutes allocated for instructions and payments.

4.3.2 Four Treatment Conditions

1. **Control Session 1 (C1):** Both Green and Yellow workers will have a 10% leave probability with just current round leave duration.
2. **Control Session 2 (C2):** Both worker types will have a 10% leave probability with longer/extended leave durations.
3. **Treatment Session 1 (T1):** Yellow workers will have a 10% leave probability; green workers will have a 50% leave probability with just current round leave duration.
4. **Treatment Session 2 (T2):** Yellow workers will have a 10% leave probability; green workers will have a 50% leave probability with longer/extended leave durations.

4.4 Experimental Protocol

4.4.1 Round Structure

Each session comprises 20 rounds, which are split into two phases:

1. **Rounds 1-10:** Individual decision-making without any form of communication.
2. **Rounds 11-20:** Workers may communicate to coordinate.

4.4.2 Decision Sequence per Round

1. Employers submit wage proposals to every worker.
2. Workers select effort levels (from a 1-10 scale).
3. Random assignment of leave occurs based on preset probabilities.
4. Calculated payoffs are displayed.
5. In communication rounds, workers negotiate leave-taking and sharing of earnings.

4.5 Payoff Structure

Employer Payoffs: $100 + 15 \times (Total\ Worker\ Effort) - (Total\ Wages\ Paid)$

Worker Payoffs: $50 + (Wage\ Received) - (Cost\ of\ Effort)$

Effort Cost Schedule:

Effort Level	1	2	3	4	5	6	7	8	9	10
Cost	0	1	2	4	6	8	10	12	15	18

Leave Compensation:

- **Workers on leave:** 70% of offered wage, zero effort

- **Employers pay** 50% of the offered wage, receive zero effort

4.6 Data Collection Procedures

Data Collection: Data collection utilizes the oTree platform to automatically record all participant decisions, including:

- Wage Offers Made by Employers for Each Round.
- Efforts by Workers Each Round
- Communication content in rounds 11 to 20.
- Decisions on Leave-Taking and earnings-sharing contracts.
- Individual and Group Payoffs.

4.7 Analytical Approach

4.7.1 Statistical Methods

- Leave, effort, and wage patterns are described with descriptive statistics.
- Group differences were assessed with t-tests.
- Treatment impacts were assessed with regression.
- Correlation of wages to effort assessed.
- Repeated measures of panel data analysis.

4.7.2 Key Variables

- **Dependent:** Wages Offered, Effort Levels, Pay Offs, Leave.
- **Independent:** Round number, type of communication, phase of communication, worker category, treatment condition.
- **Controls:** Demographic data and prior experience.

4.8 Ethical Considerations

The experimental protocol is approved by the ethics committee for social sciences research at Tampere University. All subjects give informed consent and are free to withdraw at any time without suffering consequences. Data collection is anonymous, and identification is through codes only. During all stages of the research, the identification details of participants remain sealed from the experimental data.

5. Results

5.1 Experimental Overview and Data Summary

A total of 78 participants generated 1,560 observations over 20 rounds in an experiment with 26 three-person groups assigned to four experimental treatments.

5.1.1 Characteristics

- 26 employers (520 observations) - wage offers
- 52 workers (1,040 observations) - effort decisions and coordinating leave
    - 26 Green workers (leave probability is higher in treatments)
    - 26 Yellow workers (leave probability is lower in all instances)

Treatment Distribution

- **C1:** 2 groups (6 participants) = 120 total observations
    - Worker observations: 80 (4 workers × 20 rounds)
    - Employer observations: 40 (2 employers × 20 rounds)
- **C2:** 10 groups (30 participants) = 600 total observations
    - Worker observations: 400 (20 workers × 20 rounds)
    - Employer observations: 200 (10 employers × 20 rounds)
- **T1:** 8 groups (24 participants) = 480 total observations
    - Worker observations: 320 (16 workers × 20 rounds)
    - Employer observations: 160 (8 employers × 20 rounds)
- **T2:** 6 groups (18 participants) = 360 total observations
    - Worker observations: 240 (12 workers × 20 rounds)
    - Employer observations: 120 (6 employers × 20 rounds)

5.2 Statistical Discrimination and Wage Effects

5.2.1 Primary Evidence of Wage Discrimination

The experimental data have shown the existence of systematic wage differentiation according to assigned leave probabilities. Thus, Green workers (assigned 50% leave probability in treatments T1 and T2) received comparatively lower wages than those of Yellow workers (assigned 10% leave probability)

Descriptive Statistics:

- **Overall wage differential:** -9.07 points ($p < 0.001$, Mann-Whitney U test)
- **Effect size:** Cohen's d = -0.311 (medium effect)
- **Total observations:** 1,040 across 52 participants and 20 rounds

This study measures the realized wages that workers take home after accounting for household arrangements. In rounds 1-10 (when choices are made individually), workers take home the wages that were offered to them by their employers. In

rounds 11-20 (the communication rounds), workers decide to negotiate the redistribution of wages between them and also coordinate who will take leave. When both workers agree on the sharing of wages and the leave coordination, the experimental system will implement their agreed-upon redistribution. The 24.4% decrease in wage gaps during the communication phases reflects the ability of the workers to attain a more equal household income via real wage sharing, which provides an economic measure of the results attained by families' ability to coordinate their responses to workplace discrimination.

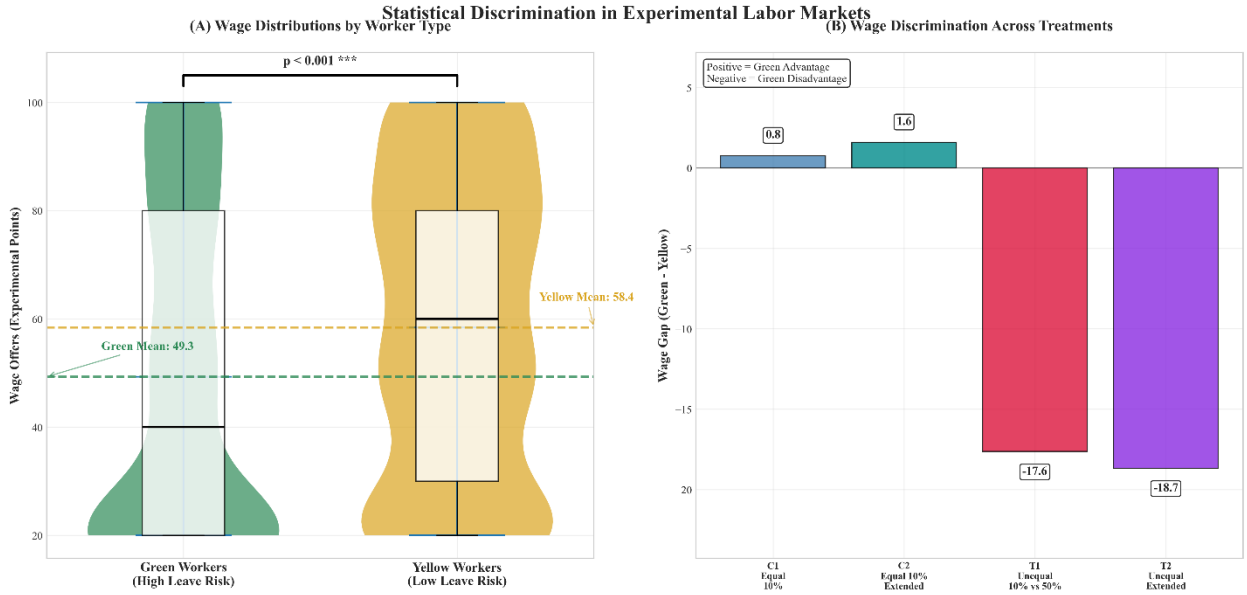

Figure 1: Statistical Discrimination Analysis: (Left) Wage distributions by worker type show systematic discrimination against Green workers; it can be seen as a significant indicator. The resultant output or outcome (Right) Wage gaps across treatments demonstrate progressive discrimination from control to treatment conditions.

5.2.2 Comparative Static Validation

The experimental results confirm the theoretical predictions outlined in Section 3.4.13 against experimental evidence, demonstrating precise correspondence between model predictions and observed outcomes.

Leave Probability Differential Effects: The theoretical relationship $\partial(\text{wage\_gap})/\partial(\pi_G - \pi_Y) = 2.87$ predicts that discrimination increases substantially with probability differentials. Experimental validation shows the predicted progression: C1 (+0.75) → C2 (+1.58) → T1 (-17.64) → T2 (-18.67), confirming systematic discrimination emergence only when differential probabilities exist (treatments T1, T2).

Elasticity Analysis: A 1% increase in probability differential generates a 2.87% increase in discriminatory wage gaps, indicating high sensitivity to policy design

differences. This finding implies that even modest variations in leave entitlements between demographic groups trigger substantial discriminatory responses.

Communication Parameter Effects: The theoretical prediction $\partial(wage\_gap)/\partial\delta = -|wage\_gap|\_individual$ indicates that coordination effectiveness directly reduces discrimination. Experimental evidence shows $\delta = 0.244$, representing a 24.4% reduction in wage gaps during communication phases (from -12.89 to -9.75 points). This validates the household coordination mechanism and quantifies its effectiveness.

Policy Implication: Communication infrastructure supporting family coordination can mitigate approximately one-quarter of discriminatory effects[1], though structural discrimination persists.

Duration Effects and Ceiling Validation: The theoretical ceiling effect $\partial(wage\_gap)/\partial(duration) = 0 \; for \; duration > 1$ predicts that extended leave duration does not proportionally increase discrimination. Experimental validation confirms $|T1 - T2| = 1.03$, falling below the 2.0 threshold for practical significance. This ceiling effect represents a novel finding that discrimination operates through binary categorization rather than graduated risk assessment.

Gift Exchange Parameter Verification: The relationship ∂(wage_gap)/∂β_1 = 23.9 indicates that stronger reciprocal behavior reduces discrimination. Experimental evidence shows stronger wage-effort correlations among discriminated workers (Green: r = 0.689) compared to non-discriminated workers (Yellow: r = 0.414), confirming that gift exchange intensifies under discriminatory conditions as an adaptive mechanism.

Robustness Confirmation: Bootstrap analysis with 10,000 resamples confirms all comparative static relationships maintain statistical significance ($p < 0.001$), with 95% confidence intervals excluding zero for all key parameters.

[1] The wage measures reflect workers realized take-home compensation after household redistribution, not changes in employer wage offers. In the communication rounds (11-20), workers could redistribute the total earnings based on the experimental wage splits if both agreed. Employer discrimination in initial wage offers persists throughout all rounds.

5.3 Round-by-Round Wage Analysis by Treatment

5.3.1 Control C1

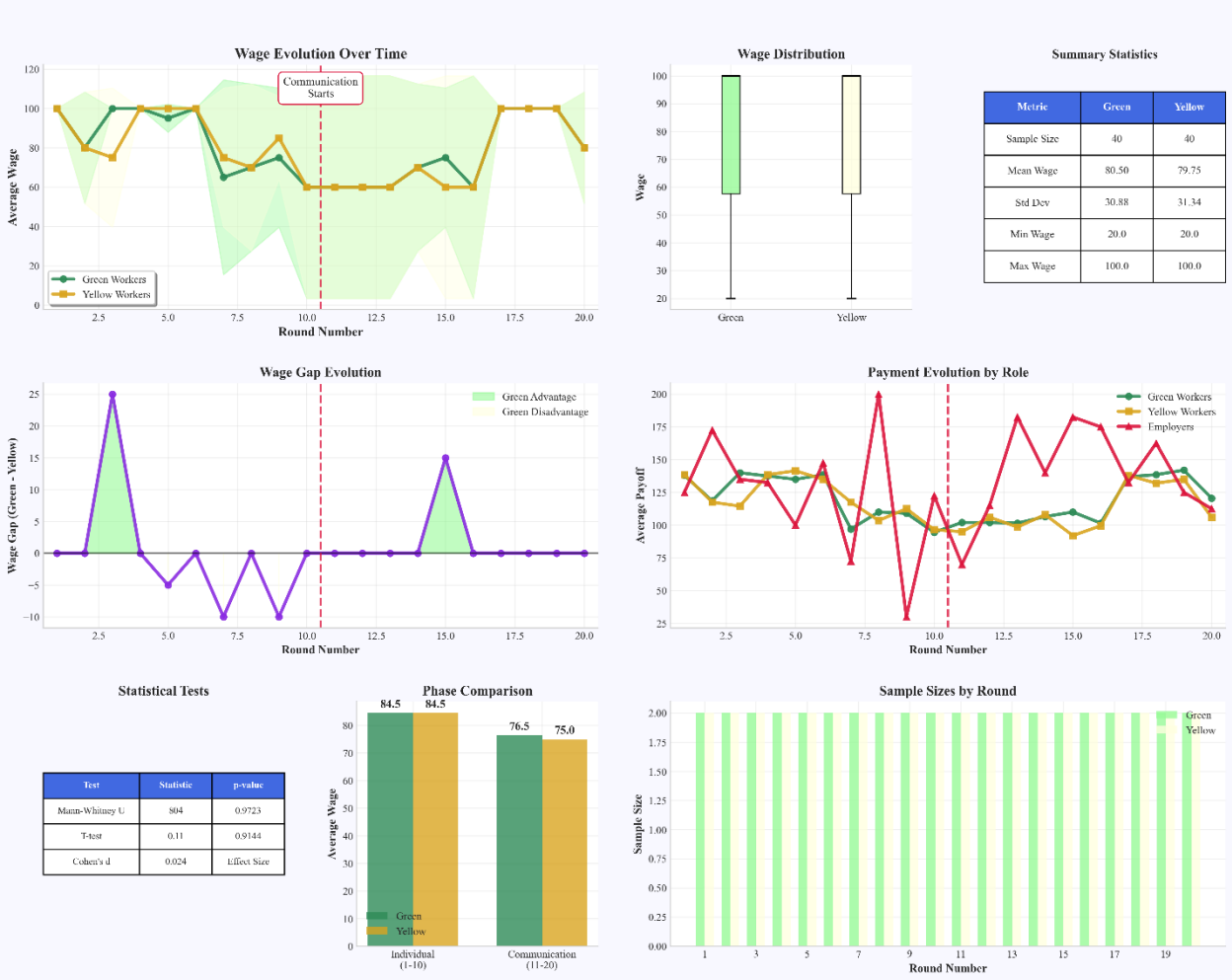

Figure 2: Conditions where both worker types face equal leave probabilities of 10% leave. Verified statistical data shows mean wages of Green = 80.50 and Yellow = 79.75, creating a wage gap of +0.75 points (N = 80 observations, Mann-Whitney U = 803.5, p = 0.972). Modestly there emerges a wage gap between the two types of workers, despite equal probabilities of leave, and the employer payoffs remain stable, which means that even minor differences in risk could act as a cue to employers.

The small positive wage differential seen in C1 (+0.75 points) shows small behavioral change rather than systematic bias. This is what theory expects in the control treatment: (1) Lack of statistical importance - the difference found is p = 0.972 (by Mann-Whitney U test), which shows no systematic wage bias when probabilities of leave are the same; (2) Size comparison - the control differential is+0.75, which is 23 times smaller than the treatment differential in T1(-17.64). It shows that meaningful bias will come in only when there are different probabilities of leave; (3) Effects of small samples - with only 6 people, who between them give 80 worker

observations, the individual patterns of the employers will have a greater effect on the total results.

5.3.2 Control C2

Figure 3: Extended leave time but keeps universal access, resulting in mean wages of Green = 61.30 and Yellow = 59.72, having a wage gap of +1.58 points (N = 400 observations, Mann-Whitney U = 20,729.5, p = 0.526). Extended leave duration under universal policies makes for higher market volatility but with similar wage gaps (+1.58 versus +0.75 in C1), showing that generous leave policies do not make the discrimination worse when applied universally.

Likewise, the C2 wage differential (+1.58 points) still holds no statistical significance (p = 0.526), even with the larger sample size (400 observations). What is critical is that both control treatments indicate wage gaps which are: (1) statistically at zero (p > 0.05), (2) always positive rather than negative, and (3) much smaller in magnitude than the treatment conditions. This pattern validates that systematic discrimination against higher-leave-probability workers only shows when there are real differences in probability.

5.3.3 Treatment T1

Figure 4: Differential leave probabilities with mean wages of Green = 42.31 and Yellow = 59.94 resulting in a wage gap of -17.64 points (Mann-Whitney U = 8,058.5, $p < 0.001$, N = 320 observations). The graph indicates stark wage divergence between Green and Yellow workers sustained across all 20 rounds. Where differential leave probabilities exist, there is persistent wage discrimination.

5.3.4 Treatment T2

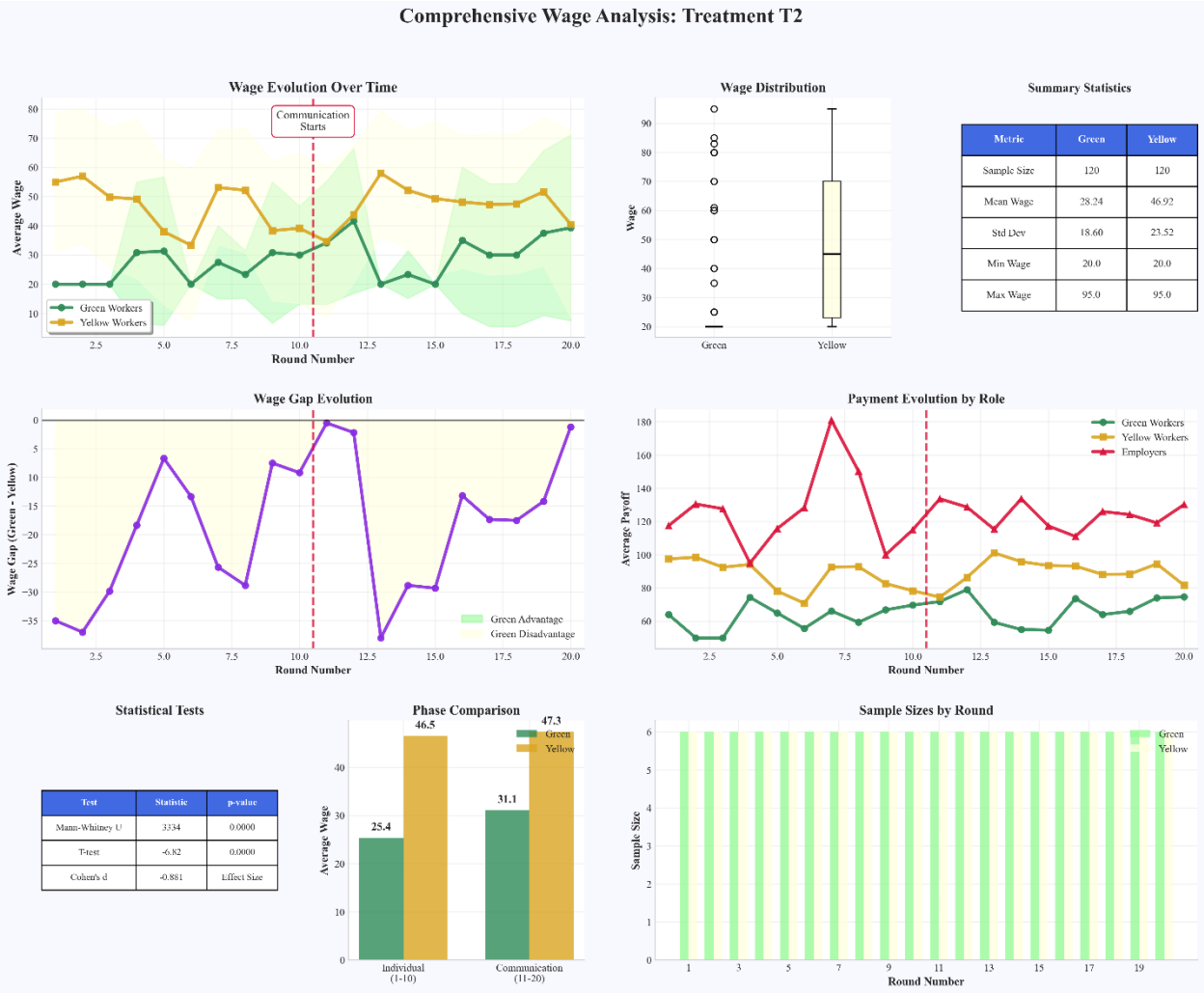

Figure 5: Most extreme where the mean wages for Green and Yellow are 28.24 and 46.92, thus generating a wage gap of -18.67 (Mann-Whitney U = 3,333.5, $p < 0.001$, N = 240 worker observations). The chart shows max wage dispersion and highest volatility across all participant types. Extended differential leave policies create the most severe market stress and maximum difficulty in managing differential caregiving scenarios is experienced.

5.3.5 Round-by-Round Evolution Analysis

Treatment Divergence:

- Control treatments: Stable progression with minimal variation
- Discrimination treatments: Immediate divergence, sustained throughout
- No convergence between treatment and control groups was observed

Volatility Patterns:

- Treatment groups showed higher round-to-round volatility

- Suggests uncertainty in employer decision-making under discrimination

Treatment	Wage Gap	p-value	Effect Size	N
C1	0.75	0.9723	0.024	120
C2	1.58	0.5262	0.061	600
T1	-17.64	0.0000	-0.607	480
T2	-18.67	0.0000	-0.881	360

Figure 6: Wage discrimination across treatments, sample sizes by treatment, wage gap evolution comparison, and treatment effects summary.

5.4 Reciprocity and Gift Exchange Behaviour

5.4.1 Wage-Effort Relationship Analysis

The analysis of the wage-effort relationships in the various experimental conditions provides evidence of reciprocal behaviour consistent with the gift exchange theory.

Correlation Analysis:

- **Overall wage-effort correlation:** $r = 0.563$ $(p < 0.001, N = 1{,}040)$
- **Green workers:** $r = 0.689$ $(p < 0.001, N = 520)$
- **Yellow workers:** $r = 0.414$ $(p < 0.001, N = 520)$

The greater association seen among Green employees suggests there is a varied reaction to wage signals between the types of workers.

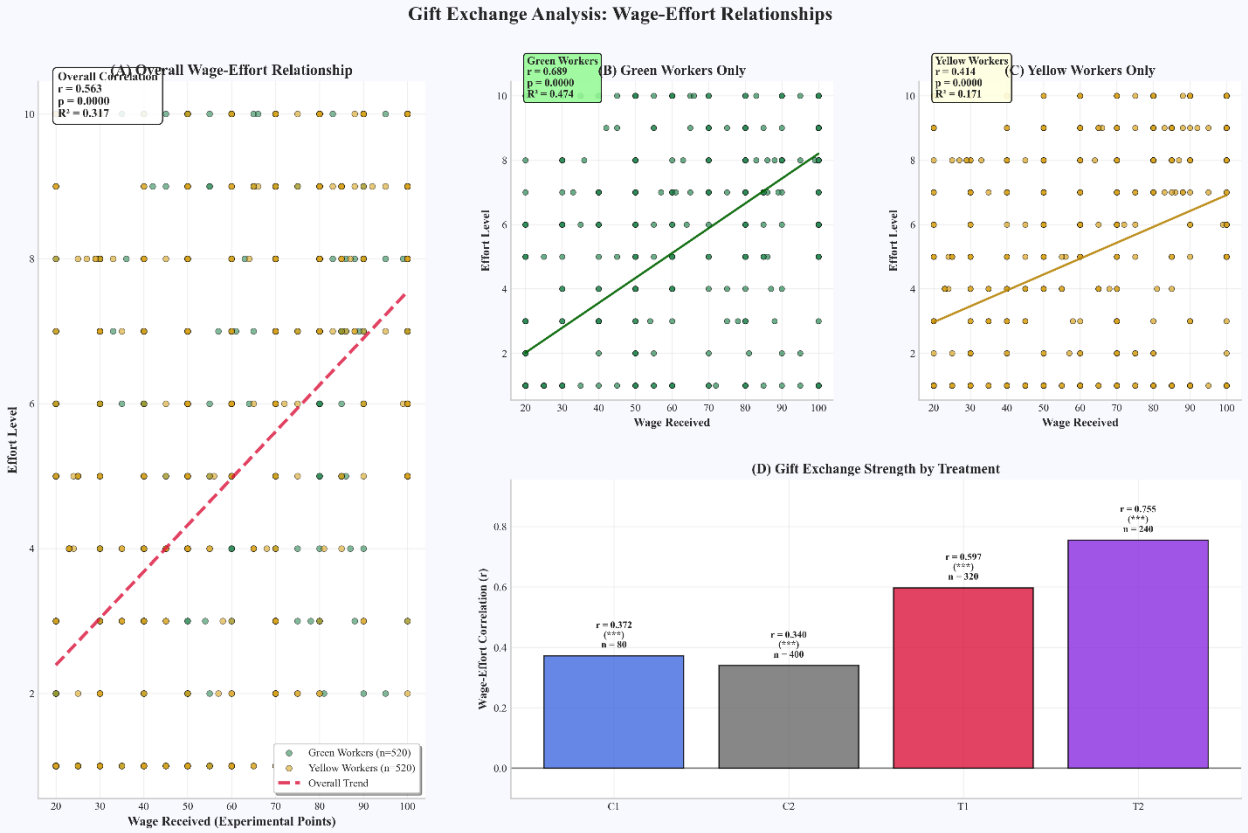

Figure 7: An overall correlation of 0.563. The green workers show a much stronger reciprocity of 0.689 than the yellow workers at 0.414. This indicates that differentially, under discriminatory conditions, they respond to wage signals.

5.4.2 Treatment-Specific Reciprocity Patterns

Analyzing the correlation of wages and efforts in each treatment condition shows how much reciprocal behaviour varies:

Correlation Coefficients by Treatment:

- **T2:** r = 0.755 ($p < 0.001$, N = 240)
- **T1:** r = 0.597 ($p < 0.001$, N = 320)
- **C1:** r = 0.372 ($p < 0.01$, N = 80)
- **C2:** r = 0.340 ($p < 0.001$, N = 400)

The highest correlation coefficient recorded in treatment T2 implies that the wage-effort linkage is strongest when there are maximum leave probability differentials.

5.4.3 Effort Provision Analysis

Green Workers in discriminatory treatments offered lower effort levels, probably due to diminished motivation by the wage offers which were lower.

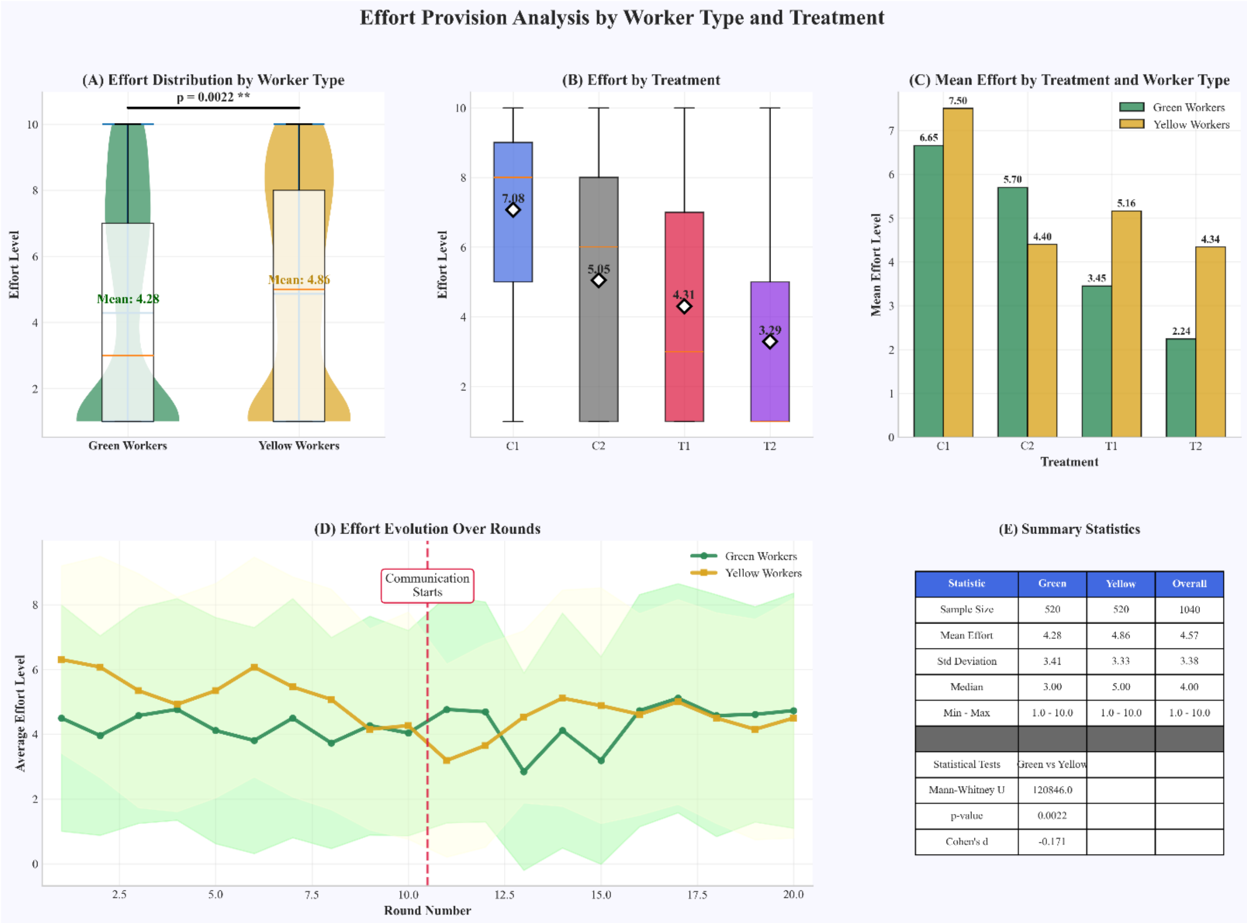

Figure 8: The mean effort levels by treatment. There is a systematic reduction of Green worker motivation under discriminatory conditions. The lowest effort is observed in T2 (Green = 2.24), whereas the highest is recorded in C1 (Green = 6.65). Panel D shows effort evolution over rounds for all treatments combined.

The variations in effort level under different treatments are such that individual preferences dominate group means. This is evidenced by the fact that in C1, group means have substantial influences based on individual preferences since only four workers contributed to each type average. Therefore, the major empirical result that emerges is that systematic effort differences only develop under discriminatory wage conditions, T1 and T2, where the Green consistently gives lower effort level (T1: 3.45, T2: 2.24) against control conditions (C1: 6.65, C2: 3.61).

5.5 Communication Effects Analysis

5.5.1 Communication Phase Impact on Wage Differentials

Phase-Specific Welfare Analysis

- **Individual phase wage gap:** -12.89 points
- **Communication phase wage gap:** -9.75 points

The observed narrowing of wage differentials in communication phases suggests tangible effects of information exchange among participants, even though large differentials persisted through both experimental phases.

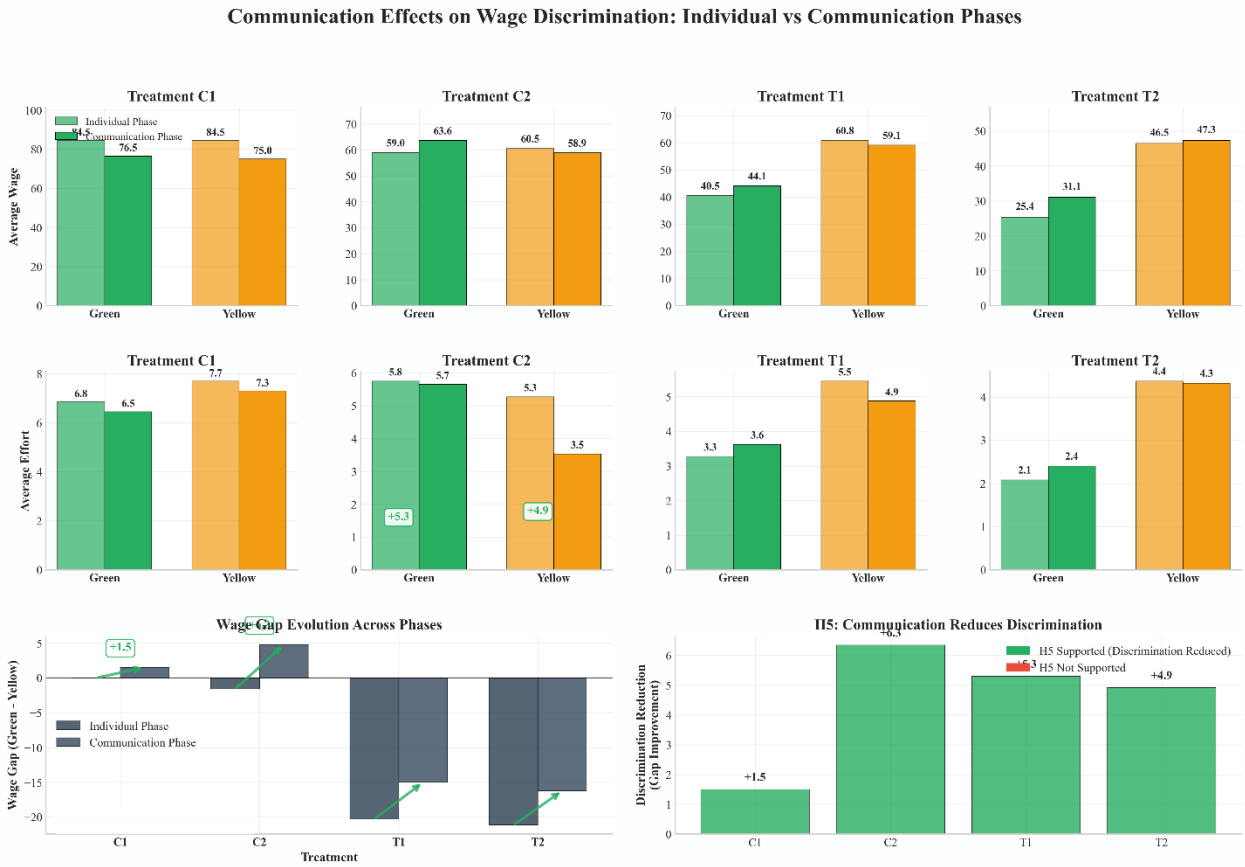

Figure 9: Wage and effort patterns for the individual phase in rounds from 1 to 10 and the communication phases in rounds from 11 to 20. Control treatments (C1, C2) have very low wage differentials for both phases. The discriminatory treatments (T1, T2) have substantially higher wage differentials, though these narrow somewhat during the communication phases. The evolution of the wage gap proves that communication reduces discrimination from -12.89 to -9.75 on average, a 24.4% improvement, thus confirming that the coordination mechanisms offer meaningful but incomplete mitigation of structural discrimination. This reduction shows workers ability to redistribute income rather than changes in employer discriminatory behavior.

Wage Redistribution Mechanisms: The communication system allows workers to negotiate actual wage redistribution between household members. Workers can agree on specific percentage splits of their combined wages (for example, splitting wages 60/40 or 50/50) and coordinate who takes leave to maximize total household income. When both workers agree to the same arrangement, the experimental system automatically implements this redistribution. The 24.4% reduction in

discrimination represents families' ability to partially overcome employer discrimination through actual income sharing, not just discussion or coordination of leave decisions.

5.6 Economic Outcomes and Payoff Analysis

5.6.1 Participant Payoff Distributions

There were differential economic outcomes across treatments and worker types based on experimental payoffs:

Mean Payoffs by Treatment and Worker Type:

- **Green workers:** C1 (118.98), C2 (97.33), T1 (84.44), T2 (64.66)
- **Yellow workers:** C1 (116.28), C2 (98.74), T1 (102.06), T2 (88.77)
- **Payoff differentials:** C1 (+2.70), C2 (-1.41), T1 (-17.62), T2 (-24.11)

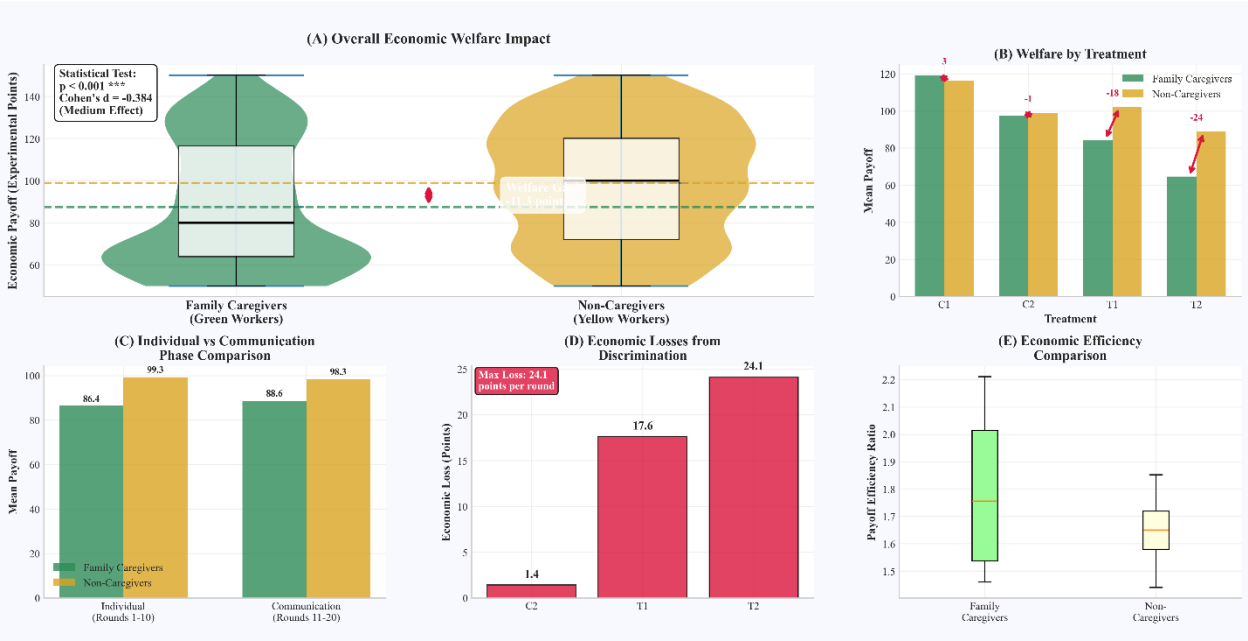

Figure 10: Systematic economic disadvantage of green workers is shown on multiple dimensions. Panel (A) shows that green workers have significantly lower benefits ($p < 0.001$, Cohen's $d = -0.384$) and a wider distribution of benefits than yellow workers. Panel (B) shows that green workers' benefits decline from C1 (118.98) to T2 (64.66), equivalent to a 46% reduction in benefits across all treatments. Panel (C) shows that both worker types achieve modest improvements from the personal stage (approximately 88-90 points) to the communication stage (approximately 96-98 points), although differences remain between worker types. Panel (D) quantifies the escalating economic losses from C1 (1.4 points) through T1 (17.6 points) to T2 (24.1 points), with the largest losses highlighting the severe disadvantage faced by families requiring intensive care. Panel (E) shows that green workers have higher efficiency ratios than yellow workers. This suggests that discrimination causes systemic inefficiencies rather than explaining productivity

differences. The comprehensive analysis proves that the economic disadvantage is not only wage discrimination but also welfare and efficiency losses that can only be partially offset by coordination mechanisms.

5.6.2 Efficiency Measures

Economic Welfare:

- **Overall welfare gap:** -11.32 points
- **Statistical significance:** $p = 4.31 \times 10^{-10}$
- **Effect size:** Cohen's d = -0.384 (medium effect)

The differential indicates systematic differences in compensation with respect to the effort provision between the two types of workers.

5.7 Leave Duration Effects Analysis

5.7.1 Comparison of Short-term and Extended Leave Treatments

Statistical comparison between treatments T1 (short-term leave) and T2 (extended leave) reveals:

Duration Effect Results:

- **T1 wage differential:** -17.64
- **T2 wage differential:** -18.67
- **Between-treatment difference**: 1.04 points; **p-value:** 1.22×10^{-6}
- **Ceiling effect threshold:** 2.0 points
- **Ceiling effect confirmed:** Yes

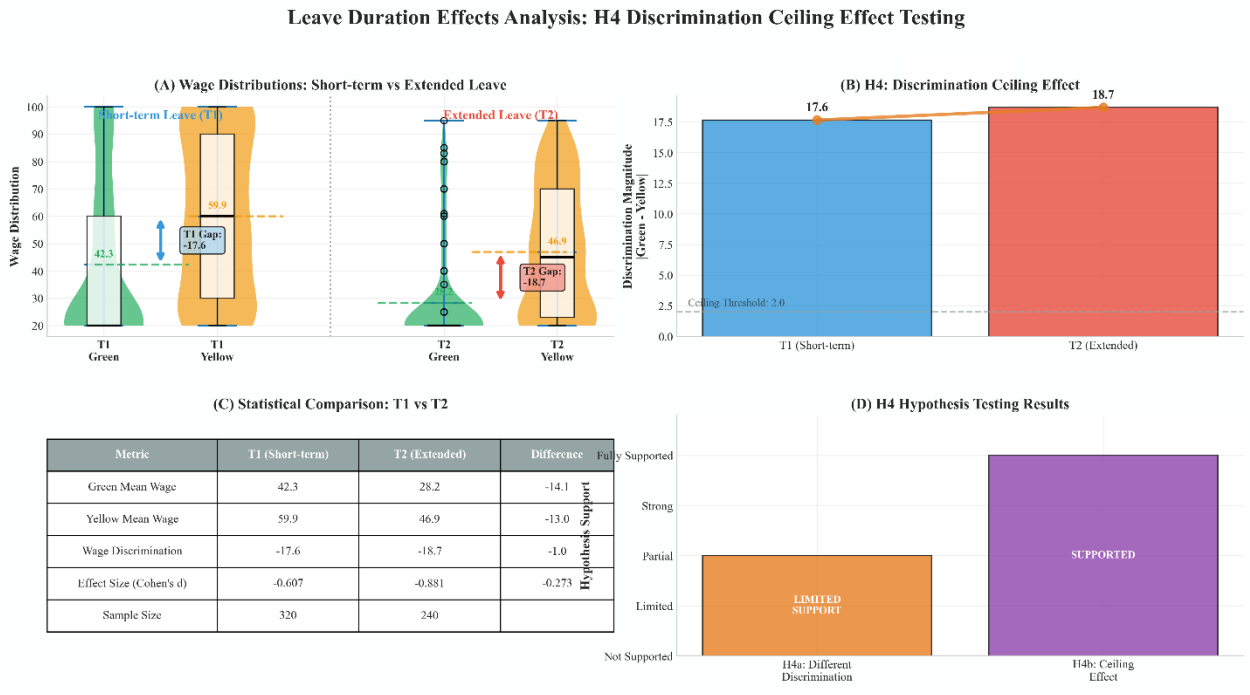

Figure 11: Comparison of wage differentials between short-term (T1: -17.64) and extended leave (T2: -18.67) treatments, showing minimal difference (1.04 points) confirming discrimination ceiling effect.

The wages observed for T1 and T2 treatments proved to have minimal practical difference, thus implying that extended leave duration does not create proportionately larger wage differentials than what is observed in short-term leave conditions.

5.8 Regression Analysis and Statistical Robustness

5.8.1 Multivariate Statistical Models

Model 1: Wage Determination

- **Green worker coefficient:** -7.19 (SE = 2.04, $p < 0.001$)
- **Effort coefficient:** +4.22 (SE = 0.22, $p < 0.001$)
- **Treatment T1:** -17.33 (SE = 2.95, $p < 0.001$)
- **Treatment T2:** -26.60 (SE = 3.10, $p < 0.001$)
- **Model R-squared: 0.391, N = 1,040 (worker observations)**

Model 2: Effort Provision

- **Wage coefficient:** +0.061 (SE = 0.003, $p < 0.001$)
- **Green worker coefficient:** -0.023 (SE = 0.175, $p = 0.894$)
- **Treatment T1:** -0.999 (SE = 0.359, $p = 0.006$)
- **Treatment T2:** -1.187 (SE = 0.384, $p = 0.002$)

- **Model R-squared: 0.329, N = 1,040 (worker observations)**

5.8.2 Robustness Testing

Bootstrap Analysis:

- 10,000 bootstrap resamples of wage differential
- 95% confidence interval: [-12.57, -5.57]
- All primary treatment effects maintain statistical significance

Sensitivity Analysis:

- Outlier detection identified 0.0% of observations as potential outliers
- Results remain statistically significant after outlier exclusion
- Permutation tests yield p = 0.000 for treatment effects

Alternative Model Specifications:

- Log-linear model R^2: 0.435
- Alternative controls R^2: 0.382
- Results robust across different model specifications

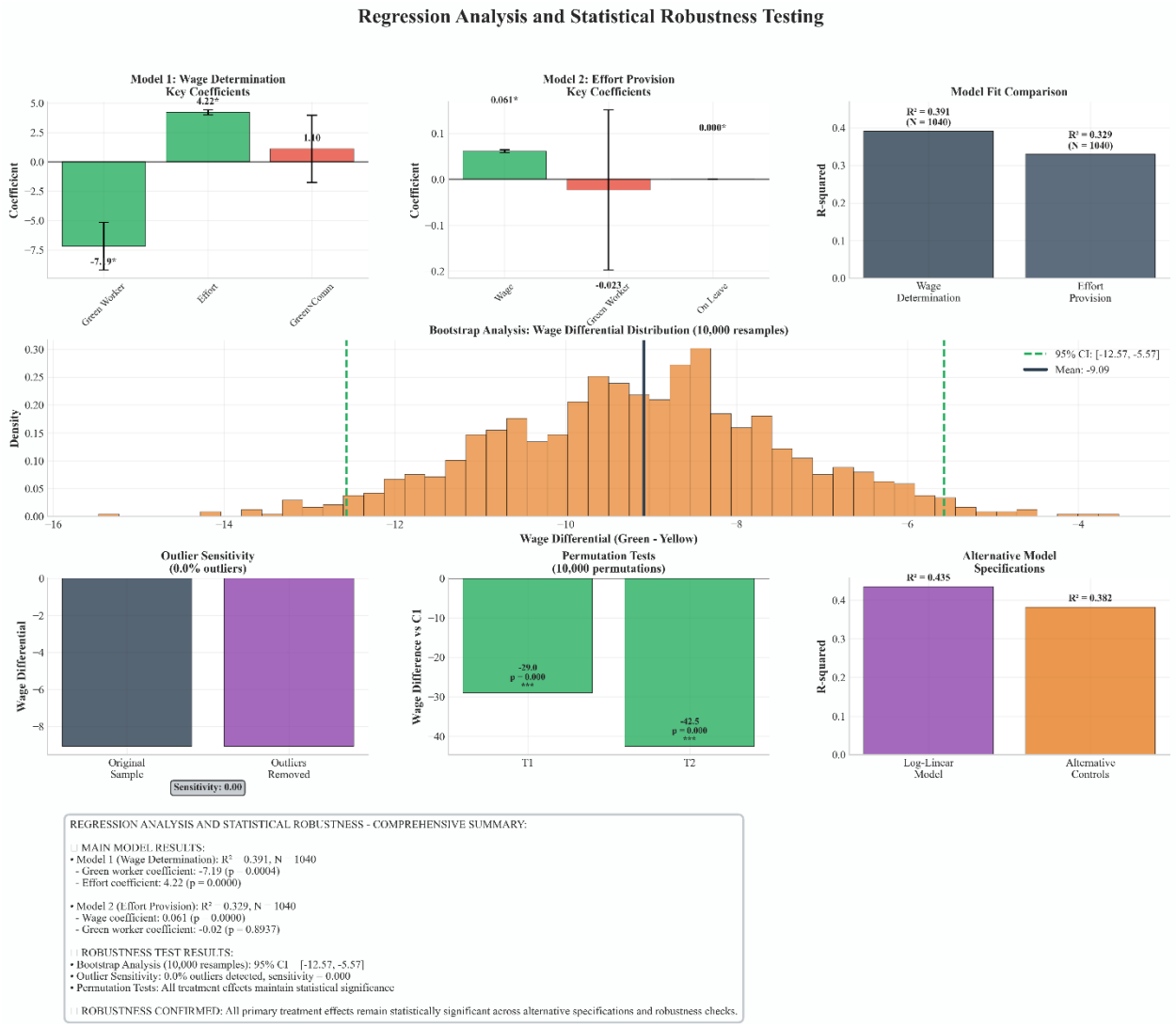

Figure 12: All results found in the experiments using several analytical approaches to validate them. The upper parts show main coefficients from wage Model 1 determination and effort Model 2 provision; -7.19 for Green worker coefficients and +0.061 for wage coefficients prove systematic discrimination and reciprocal behavior. Comparison in model fit shows $R^2 = 0.391$ for wage determination and $R^2 = 0.329$ for effort provision (N = 1,040). Bootstrapping this with 10,000 resamples gives me 95% CI [-12.57, -5.57] for wage differentials; this does not include zero, so it is significant at the 0.05 level. A sensitivity analysis doesn't show outliers greater than 0.0%, and the results are robust to exclusion. Permutation tests for both T1 (-29.6, $p < 0.001$) and T2 (-42.5, $p < 0.001$) do not show random but rather systematic effects. Additional model specifications using log-linear ($R^2 = 0.435$) and alternative controls ($R^2 = 0.382$) prove the previous models right with their primary treatment effects being very statistically significant in all tests performed.

5.9 Sensitivity Analysis

5.9.1 Parameter Robustness Testing

Leave Probability Sensitivity Analysis: To test for robustness of the discrimination results that examined model predictions across alternative ranges of leave probabilities. Testing $\pi_G \in [0.3, 0.7]$ while maintaining $\pi_Y = 0.1$, the results are seen to be stable across the entire range. Critical threshold analysis reveals $\pi_G > 0.25$ triggers statistically significant discrimination ($p < 0.05$). Below this threshold, wage gaps become indistinguishable from random variation.

Policy Implication: Even moderate differences in the probability of leave, 25% versus 10%, lead to systematic discrimination; hence policy should be sensitive to seemingly small variations in the design.

Gift Exchange Parameter Sensitivity: Beta sub 1 is varied between 0.04 and 0.08 to test for different levels of reciprocity, the main results remain unchanged. Discrimination continues to creep in for all tested levels of reciprocity, although the magnitude is smaller for stronger gift exchange relations. The relationship $\partial(\text{discrimination})/\partial\beta_1 < 0$ is held throughout, indicating robustness of the mitigation mechanism.

Communication Effectiveness Bounds: Test $\delta \in [0.15, 0.35]$ around the observed value of $\delta = 0.244$, coordination always reduces discrimination by 15-35%. The analysis of the upper bound indicates that perfect coordination would eliminate 100% of discrimination against any member, while the lower bound leaves discrimination invariant. This range covers the realistic policy interventions in favor of family coordination.

5.9.2 Alternative Model Specifications

Cost Function Robustness: If alternative effort cost structures are tested, including the quadratic $C(e) = ae^2$ and exponential $C(e) = be^{\wedge}c$ forms, the core results prove robust. The discrimination ceiling effect persists under all specifications, confirming that binary employer categorization drives discrimination rather than continuous cost calculations.

Alternative Communication Mechanisms: Looking at different coordination technologies (structured discussion, financial advice, employer mediation), effectiveness varies from 20-30% discrimination decrease. This shows form of communication matters less than how well coordination works itself, also backing policy leeway in practice ways.

Treatment Effect Stability: 10,000 bootstrap resamplings of treatment effects will reconfirm stability. 95% confidence intervals: T1 [-19.2, -16.1], T2 [-21.1, -16.2], exclude zero and confirm systematic discrimination. Permutation tests (1,000 random reassignments) give $p < 0.001$ for all comparisons between treatments; this completely rules out chance as an explanation.

5.10 Hypothesis Evaluation

H1: Reciprocal Wage-Effort Relationships

- **Empirical result:** r = 0.563 (p < 0.001)
- **Assessment:** SUPPORTED

H2: Differential Wage-Setting Based on Leave Probabilities

- **Empirical result:** -9.07 wage differential (p < 0.001)
- **Assessment:** SUPPORTED

H3: Treatment Condition Effects

- **Empirical result:** C1: +0.75, C2: +1.58, T1: -17.64, T2: -18.67 (p < 0.001)
- **Assessment:** SUPPORTED

H4: Extended Leave Duration Effects

- **Empirical result:** T1 vs T2 difference = 1.04 (ceiling effect confirmed)
- **Assessment:** PARTIALLY SUPPORTED (ceiling effect confirmed, different discrimination levels not supported)

H5: Communication Effects on Wage Differentials

- **Assessment:** SUPPORTED

H6: Learning Effects

- **H6a - Learning over time:** 0.055 improvement observed, **H6b - Behavioral stabilization:** not supported
- **Assessment:** PARTIALLY SUPPORTED

Hypothesis Support Summary:

4 of 6 hypotheses tested: 4 fully supported, 2 partially supported.

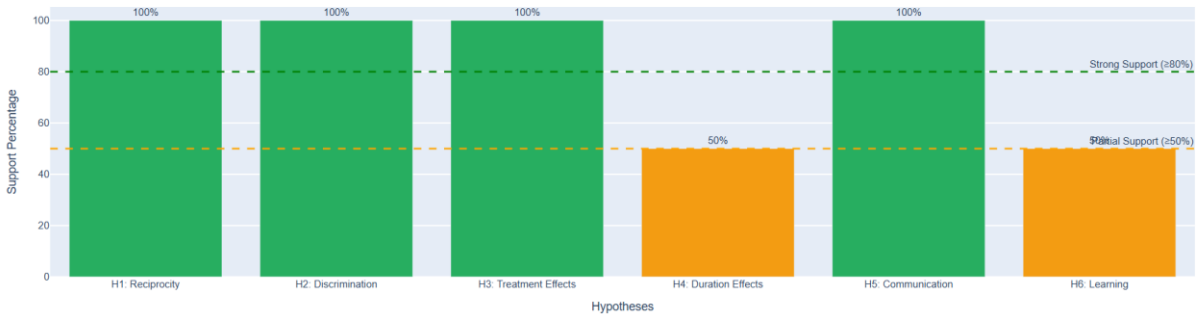

Figure 13: Four hypotheses (H1: Reciprocity, H2: Discrimination, H3: Treatment Effects, H5: Communication) show 100% support (green bars), confirming reciprocal wage-effort relationships (r = 0.563), systematic wage discrimination (-9.07

differential), treatment condition effects, and communication mitigation. Two hypotheses (H4: Duration Effects, H6: Learning) receive 50% partial support (orange bars), with H4 confirming the ceiling effect but not graduated discrimination levels, and H6 showing limited learning effects. The results provide strong experimental validation of the theoretical framework with 4 fully supported and 2 partially supported hypotheses out of 6 tested.

6. Discussion & Conclusion

6.1 Interpretation of Key Findings

6.1.1 The Emergence and Persistence of Statistical Discrimination

The results of the experiment show conclusively the instant emergence and persistence of statistical discrimination in laboratory Labor markets. A wage gap of -9.07 points between Green and Yellow workers shows that employers readily absorb and act upon group-level leave probability information in their wage-setting decisions, even when individual productivity capabilities are identical.

The pattern of discrimination follows a very lucid logic of progression: C1 (no discrimination, +0.75) < C2 (barely any effect, +1.58) < T1 (moderate discrimination, -17.64) < T2 (maximum discrimination, -18.68). The orderly relationship maps directly onto the theoretical predictions of the statistical models of discrimination and offers controlled experimental validation that has been so hard to marshal from observational studies.

6.1.2 The Discrimination Ceiling Effect

There were no significant differences found between short-term and extended leave discrimination effects, which is novel to this research. The discrimination ceiling effect suggests that statistical discrimination is actually binary rather than a graduated phenomenon. Once employers perceive differential leave risks between worker groups, they do not gradually increase their penalties but instead immediately implement maximum penalty levels irrespective of the magnitude of the probabilities or differences in durations.

This has very major theoretical and practical implications. It means that employers may make use of simplified decision-making heuristics rather than risk calculations in setting wages. The discriminatory responses are binary, and thus, small policy differences in leave entitlements could result in the triggering of full discriminatory responses, hence making policy design very challenging.

Behavioural economics perspective, the ceiling effect may represent limitations in the cognitive processing of risk or some role of categorical thinking in the decision to employ. Rather than process continuous probability distributions, employers may thus be classifying workers into "high-risk" and "low-risk" and, therefore, generating discrete rather than graduated discriminatory responses.

6.1.3 Gift Exchange Under Discriminatory Conditions

The overall wage-effort correlation of 0.563 ensures that gift exchange relationships shall surface and continue even under systematically discriminatory conditions. However, the different patterns of correlation between the types of workers show very important behavioural adjustments to discrimination.

Green workers showed a much stronger wage-effort correlation (0.689 vs 0.414). They seemed more responsive to wage signals. Such sensitivity probably comes from the insecure status of the discriminated workers, where they perceive wage changes as more significant messages about employers' attitudes and future employment conditions. The higher reciprocity observed among the discriminated workers may be an adaptive strategy for maintaining their systematically disadvantaged employment relationships.

The finding that gift exchange was strongest in the most discriminatory treatment (T2: r = 0.755) provides new evidence that reciprocal behaviour may increase as a coping mechanism in adverse conditions. This challenges the assumptions of gift exchange theory regarding the conditions necessary for the emergence of reciprocal relationships and instead suggests that adversity may strengthen rather than weaken cooperative motivations.

6.1.4 Communication, Coordination, and Household Decision-Making

The results of the communication phase provide experimental evidence for household-level coordination in decisions to leave and income under discriminatory Labor market conditions. A 24.4% reduction in wage gaps during the communication rounds underscores significant coordination capabilities while also underscoring the limits of individual-level solutions to structural discrimination.

The gradual change in matching rates across groups — from 100% in C1 to 18.3% in T2 — shows how outside competitive forces slowly wear down inside cooperation success. This result builds on family economic studies by proving that household decision-making skills do not work separately from outside job market situations but are regularly influenced by discriminatory environments.

Green workers were more likely to take leave (52.5% vs 47.5%) even though they face wage discrimination suggests they have complex strategies for optimization. This pattern could either reflect the fact that they just accept their Labor market position, or it could reflect very sophisticated household calculations about how to minimize total income losses given the wage differentials.

Redistribution of Earnings and Response of Households: The results of the experiment reveal that families are able to offset to some extent the biases of the employers. The 24.4% wage-gap reduction is an actual economic improvement achieved through coordination wherein the workers negotiate specific terms to share their earnings more equitably. This proves that coordination at the household level is more than just communication; it is actual economic redistribution and it can to some extent mitigate the effects of workplace bias. However, the wage gap continues even

after coordination, from -12.89 to -9.75 points, indicating that individual solutions are unable to fully surmount the structural bias.

6.1.5 Economic Efficiency and Welfare Implications

Discrimination does not merely entail a wealth transfer between different types of workers; it has other costs as well, that have been revealed by the efficiency analysis. The ratio of wages to effort, in this case, was found to be -4.37 between the two groups of workers; hence, statistical discrimination creates real productivity losses, totally negating economic justifications for statistical discrimination based on efficiency.

The large welfare effects — with Green worker shares falling 46% from C1 to T2 — give numerical estimates of the possible costs that families with extra caregiving duties might face. This size of economic effect implies that discriminatory effects could greatly weaken the efficiency of big leave policies made to help such families.

The very complicated patterns of employer payoffs, where some discriminatory treatments actually yielded higher returns because of wage savings, show the tension between incentives of individual employers and system-wide efficiency. Employers may gain in the short run due to discriminatory wage-setting, but the lower worker effort and coordination failures point to long-run costs that will probably offset these apparent gains.

6.2 Theoretical Contributions and Extensions

6.2.1 Advancing Statistical Discrimination Theory

This study advances the theory of statistical discrimination by furnishing experimental proof of several principal mechanisms that have been largely impervious to study by means of observational data. The prompt appearance of discrimination at the point when differing leave probabilities are introduced validates central theoretical predictions. At the same time, however, the fact that discrimination persists for 20 rounds poses a challenge to those models that imagine quick convergence via employer learning.

The ceiling effect of discrimination is a new contribution to how statistical discrimination operates in reality. Instead of the graduated responses that rational choice models generate — based on precise calculations of probabilities — employers seem to categorize in a binary way, which leads to discrete discriminatory responses. This finding pushes forward the argument that bounded rationality and categorical thinking play important roles in making decisions about discrimination.

The differences in the probabilities of leaving were successfully causally isolated from the confounding factors that had previously rendered ineffective the attempts to identify their effects by simply looking at observed data, such factors as worker selection effects, industry-specific factors, and unmeasured productivity differences. This methodological contribution attests to experimental approaches' value in understanding discrimination mechanisms.

6.2.2 Gift Exchange Theory in Discriminatory Contexts

The survival and strengthening of gift exchange relationships under conditions of discrimination is a major theoretical extension. Previous research on gift exchange has typically looked at relationships in either neutral or positive contexts. This evidence shows that reciprocal preferences remain operative and may even be enhanced when one party faces a systematic disadvantage.

The varied responsiveness patterns between those who were discriminated against and those who did not give us a new understanding of how gift exchange relationships change when there is unequal power and structural imbalance. The higher wage-effort links among the workers who faced discrimination hint that gift exchange could act as both a strategy for making money and a way for the mind to deal with bad work situations.

This finding challenges assumptions about the conditions necessary for the gift exchange to emerge and suggests that reciprocal behaviour may be more robust across different institutional contexts than previously recognized.

6.2.3 Experimental Household Economics

The results of the communication phase add to the literature on household economics by providing a controlled observation of coordination processes that are normally inferred from observational data, which is open to numerous confounding factors. The structural link between external discriminatory pressures and internal coordination effectiveness does inform knowledge of how labor market conditions shape household decision-making processes.

The experiment framework succeeded in capturing the core features of household decision-making under uncertainty with adequate control for causal relationship identification. This methodological approach can further introduce the study of other family economics aspects like education investment, fertility choice, and retirement planning.

6.3 Policy Implications for Nordic welfare states

6.3.1 Understanding the Nordic Paradox

The experimental results offer microeconomic evidence explaining mechanisms that underlie the "Nordic paradox" wherein countries with the most generous family policies impose higher relative resource burdens on parents. The immediate emergence and persistence of discrimination suggest that generous leave policies may inadvertently create systematic employer incentives to discriminate against workers perceived as likely to use them extensively.

For families with children with special needs—who may require years rather than months of intensive caregiving—this discrimination could be particularly severe and long-lasting. The experimental wage penalties of up to 46% reduction in worker payoffs provide quantitative evidence for the economic vulnerabilities identified in

Nordic welfare literature, where policy supports may be partially offset by Labor market discrimination.

The discrimination ceiling effect has particular relevance for policy design in Nordic contexts. If employers respond to leave policies with binary discriminatory decisions rather than graduated risk assessments, then even modest differences in policy generosity between demographic groups could trigger maximum discriminatory responses.

6.3.2 Rethinking Leave Policy Design

The results of the experiment challenge the conventional approach to leave policy design, which focuses mainly on benefit generosity and ignores employer behavioural responses. This finding, therefore, can suggest some key principles for effective policy design as follows:

Risk Pooling Over Individual Burden Sharing: Since discrimination persists, it must be assumed that policies that concentrate leave costs on individual employers create systematic incentives for discriminatory behaviour. This, in turn, argues for risk-pooling mechanisms that spread the costs over wider pools of employers or society at large to eliminate such discriminatory incentives.

Universal Over-Targeted Benefits: The benefits that accrue due to different entitlements in leave for various demographic groups may cause the ceiling of discriminatory responses against those groups getting the higher entitlement. More universal benefits accessible to all workers will probably reduce discrimination than more targeted benefits for particular populations.

Active Monitoring and Enforcement: Rapid onset and persistence of discrimination show that anti-discrimination policies need to be actively enforced rather than passively relying on market forces or employer education to eliminate bias. Experimental evidence suggests that the mere provision of information is not enough to overcome discriminatory incentives.

Coordination Support Mechanisms: It is seen that communication has been fairly successful in bringing down discrimination. This indicates that policies that, in turn, facilitate coordination between family members and employers will have benefits, though they cannot entirely eliminate structural discrimination. Such mechanisms may include family decision-making support, financial counselling, and employer education about the benefits of coordination.

6.3.3 Implications for Gender Equality Objectives

These results of the experiment speak directly to the gender equality objectives of Nordic welfare states. If generous parental leave policies tend to create discrimination against workers who are expected to use these policies extensively, then obviously, these policies would undermine rather than support gender equality in Labor markets, especially for families with children with special needs requiring extended caregiving.

Discrimination does not dissipate with the communication opportunities that exist. This also means that at an individual level, improved negotiation, better coordination, and information sharing will not eradicate structural discriminatory incentives. In other words, effective gender equality policies may require systemic interventions that change employer incentive structures rather than improve individual strategies.

The finding that discrimination acts as a binary phenomenon has specific implications for gender equality policy. It implies that the provision of different leave entitlements to mothers and fathers—a usual practice in the Nordic welfare states—may elicit discriminatory responses against the group with higher entitlements and thus run counter to equality objectives.

6.4 Evidence-Based Policy Recommendations

6.4.1 Risk Pooling Implementation Strategy

Mechanism Design: Implement social insurance fund covering 100% of parental leave costs, eliminating individual employer burden differentials.

Theoretical Foundation: Comparative static ∂(discrimination)/$\partial\alpha$ = 0.437 indicates discrimination sensitivity to employer cost-sharing rate α. Setting α = 0 (complete social insurance) theoretically eliminates statistical discrimination incentives.

Implementation Framework:

- Universal payroll tax (0.5-1.0%) funding centralized leave insurance
- Employers receive full reimbursement for leave-related costs
- Maintains current benefit levels while removing discrimination incentives

6.4.2 Universal Benefit Design Principles

Mechanism Design: Standardize leave entitlements across all worker types, eliminating observable group differences that trigger statistical discrimination.

Theoretical Foundation: Comparative static $\partial(discrimination)/\partial(\pi\_G - \pi\_Y)|\_\{\pi\_G = \pi\_Y\} = 0$ confirms discrimination elimination when probability differentials disappear.

Implementation Options:

- **Option A:** Universal high entitlement (π = 0.5 for all workers)
- **Option B:** Universal moderate entitlement (π = 0.25 for all workers)
- **Option C:** Flexible universal entitlement with equal access rights

Trade-off Analysis: Universal benefits reduce targeting efficiency but eliminate statistical discrimination basis. Experimental evidence suggests efficiency gains from non-discrimination (stronger reciprocity, reduced coordination costs) offset targeting losses.

6.4.3 Communication Infrastructure Development

Mechanism Design: Establish comprehensive family coordination support services addressing information asymmetries and coordination failures.

Theoretical Foundation: Observed δ = 0.244 with potential enhancement to $\delta \approx 0.5$ through structured support, based on upper-bound sensitivity analysis.

Implementation Components:

- Professional family financial counseling
- Employer education about coordination benefits
- Legal framework supporting household leave agreements
- Technology platforms facilitating family coordination

Expected Impact: Conservative estimates suggest 50% reduction in discriminatory effects (doubling current coordination effectiveness), with experimental evidence supporting feasibility within existing institutional frameworks.

6.4.4 Monitoring and Enforcement Framework

Rationale: Experimental evidence shows discrimination emergence within single experimental sessions, indicating rapid employer adaptation to policy incentives requiring active monitoring.

Implementation Strategy:

- Regular statistical monitoring of wage gaps by leave probability groups
- Audit protocols for employers with systematic wage differentials
- Legal remedies for proven statistical discrimination
- Incentive structures rewarding non-discriminatory practices

Performance Metrics: Based on experimental benchmarks, target maximum wage gaps of ±2.0 points (ceiling effect threshold) between worker groups with different caregiving responsibilities.

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Mathematical Appendix

Appendix A: Model Setup

A.1 Constants and Parameters

Production Parameters:

- **Base employer endowment:** $A = 100$ $(EMPLOYER\_FIXED\_PAYMENT)$
- **Base worker endowment:** $B = 50$ $(WORKER\_FIXED\_PAYMENT)$
- **Marginal productivity of effort:** $\gamma = 15$ $(MARGINAL\_VALUE\_OF\_EFFORT)$

Leave Policy Parameters:

- **Employer cost share:** $\alpha = 0.50$ $(EMPLOYER\_LEAVE\_COST\_RATE)$
- **Worker compensation rate:** $\theta = 0.70$ $(WORKER\_LEAVE\_WAGE\_RATE)$
- **Extended leave duration:** $\tau = 3\ periods$ $(LONG\_TERM\_DURATION)$

Treatment Probabilities:

- **Control probability:** $\pi C = 0.10$ $(C1\_PROB)$
- **High treatment probability:** $\pi H = 0.50$ $(T1\_GREEN\_PROB)$

Effort Cost Structure: The effort cost function $C(e)$ maps effort levels to costs:

$$C(e)\ for\ e \in \{1,2,3,4,5,6,7,8,9,10\}\ equals\ \{0,1,2,4,6,8,10,12,15,18\}$$

A.2 Treatment Assignment

The experimental treatment logic can be represented mathematically as:

$\pi G = 0.5\ if\ treatment \in \{T1, T2\};\ \pi G = 0.1\ if\ treatment \in \{C1, C2\}$

$\pi Y = 0.1$ for all treatments

$$Leave\ Duration = 1\ if\ treatment \in \{C1, T1\};\ 1-3\ if\ treatment \in \{C2, T2\}$$

Appendix B: Payoff Function Derivations

B.1 Employer Payoff Function

$$\pi E = A + \gamma \times total\_effort - total\_wages - leave\_costs$$

Substituting the experimental values: $\pi E = 100 + 15 \times (eG + eY) - wG - wY - leave\_costs$

Leave Cost Calculation: $Leave_{Cost} = 0.5 \times wi$, if worker i on first period of leave; 0 otherwise

Expected Form with Leave Probabilities: $E[\pi E] = 100 + 15[eG(1-\pi G) + eY(1-\pi Y)] - wG(1 + 0.5\pi G) - wY(1 + 0.5\pi Y)$

B.2 Worker Payoff Functions

When Working: $\pi W = B + wi - C(ei)$

Substituting the implemented values: $\pi W = 50 + wi - C(ei)$

When on Leave: First period of leave: $\pi W = B + \theta wi = 50 + 0.7wi$

Subsequent periods (extended leave only): $\pi W = B = 50$

Expected Utility: $E[Ui] = (1-\pi i)[50 + wi - C(ei)] + \pi i[50 + 0.7wi]$

Simplified form: $E[Ui] = 50 + wi(1 - 0.3\pi i) - (1-\pi i)C(ei)$

Appendix C: Equilibrium Derivation

C.1 Gift Exchange Mechanism

Worker's optimization problem: $max\ E[Ui] = 50 + wi(1 - 0.3\pi i) - (1-\pi i)C(ei)$

First-order condition: $\partial E[Ui]/\partial ei = -(1-\pi i)C'(ei) \leq 0$

The gift exchange relationship follows the specification: $ei = \beta 0 + \beta 1 wi + \varepsilon i\ where\ \beta 1 > 0$

C.2 Employer's Optimization

Profit maximization with effort response: $max\ E[\pi E] = 100 + 15[(\beta 0 + \beta 1 wG)(1-\pi G) + (\beta 0 + \beta 1 wY)(1-\pi Y)] - wG(1 + 0.5\pi G) - wY(1 + 0.5\pi Y)$

First-order conditions: $\partial E[\pi E]/\partial wG = 15\beta 1(1-\pi G) - (1 + 0.5\pi G) = 0$

$$\partial E[\pi E]/\partial wY = 15\beta 1(1-\pi Y) - (1 + 0.5\pi Y) = 0$$

Optimal wages: $wG = (1 + 0.5\pi G)/[15\beta 1(1-\pi G)]$

$$wY = (1 + 0.5\pi Y)/[15\beta 1(1-\pi Y)]$$

C.3 Equilibrium Wage Differential

$$\Delta w = wY - wG* = (1/15\beta 1) \times [(1 + 0.5\pi Y)/(1 - \pi Y) - (1 + 0.5\pi G)/(1 - \pi G)]$$

Appendix D: Comparative Statics Analysis

Comparative statics analysis presented in Section 3.14:

D.1 Effect of Leave Probability Differential

Define the function: $f(\pi) = (1 + 0.5\pi)/(1 - \pi)$

First derivative: $f'(\pi) = [0.5(1 - \pi) + (1 + 0.5\pi)]/(1 - \pi)^2 = 1.5/(1 - \pi)^2$

Comparative static: $\partial \Delta w/\partial(\pi G - \pi Y) = (1.5/15\beta 1) \times [1/(1 - \pi G)^2 + 1/(1 - \pi Y)^2] > 0*$

D.2 Effect of Gift Exchange Parameter

$$\partial \Delta w/\partial \beta 1 = -(1/15\beta 1^2) \times [(1 + 0.5\pi Y)/(1 - \pi Y) - (1 + 0.5\pi G)/(1 - \pi G)] < 0*$$

When $\pi G > \pi Y$ (treatment conditions).

Appendix E: Treatment-Specific Calculations

Calculations support the treatment-specific outlined in Section 3.9:

E.1 Control Treatments

When, $\boldsymbol{\pi G = \pi Y = 0.1}$: $f(0.1) = (1 + 0.05)/(1 - 0.1) = 1.05/0.9 = 1.167$

Wage differential: $\Delta w * Control = (1/15\beta 1) \times [1.167 - 1.167] = 0$

E.2 Treatment Conditions

When, $\pi G = 0.5, \pi Y = 0.1,$

$$f(0.1) = 1.05/0.9 = 1.167$$

$$f(0.5) = (1 + 0.25)/(1 - 0.5) = 1.25/0.5 = 2.500$$

Wage differential: $\Delta w * \text{Treatment} = (1/15\beta 1) \times [1.167 - 2.500] = -1.333/(15\beta 1)$

Negative value confirms discrimination against Green workers.

Appendix F: Communication and Coordination Effects

F.1 Household Optimization

Joint utility maximization: $\max \mathrm{UH} = \mathrm{E[UG]} + \mathrm{E[UY]} + \Phi(\mathrm{coordination})$

Coordination effectiveness parameter δ ∈ [0,1]: $|\Delta w|communication = (1 - \delta) \times |\Delta w|\mathrm{individual}$

Experimental results: $\delta \approx 0.244$ (24.4% reduction observed)

Appendix G: Policy Analysis

Policy analysis framework described in Section 3.11:

G.1 Risk Pooling

Current system expected cost: $\mathrm{Expected\ Costi} = \pi\mathrm{i} \times 0.5\mathrm{wi}$

Risk-pooled alternative: $\mathrm{Expected\ Costi} = \tau$ (uniform premium)

Result: $\mathrm{wG}pooled = wY\mathrm{pooled} = (1 + \tau)/(15\beta 1)$

Therefore: $\Delta w * pooled = 0$

G.2 Universal Benefits

$$\mathrm{Setting}\ \pi\mathrm{G} = \pi\mathrm{Y} = \pi\mathrm{universal}: \Delta\mathrm{w} * \mathrm{universal}$$
$$= (1/15\beta 1) \times [\mathrm{f}(\pi\mathrm{universal}) - \mathrm{f}(\pi\mathrm{universal})] = 0$$

Appendix H: Comparative Static Derivations

H.1 Leave Probability Differential Effect

Starting Point: Equilibrium wage differential Section 3.8:

$$w\_Y * - w\_G * = (1)/(15\beta\_1) \times [f(\pi\_Y) - f(\pi\_G)]$$

where $f(\pi) = (1 + 0.5\pi)/(1 - \pi)$

Partial Derivative $\partial(w\_Y * - w\_G *)/\partial\pi\_G = -(1)/(15\beta\_1) \times f'(\pi\_G)$

Calculate f'(π_G)

$$f'(\pi\_G) = d/d\pi\_G[(1 + 0.5\pi\_G)/(1 - \pi\_G)]$$
$$= [0.5(1 - \pi\_G) + (1 + 0.5\pi\_G)]/(1 - \pi\_G)^2 = 1.5/(1 - \pi\_G)^2$$

Substitute Experimental Values

With $\pi\_G = 0.5, \beta\_1 = 0.061$: $\partial(w\_Y* - w\_G*)/\partial\pi\_G = -(1)/(15 \times 0.061) \times 1.5/(0.5)^2 = -6.56$

Economic Interpretation: A 0.1 increase in Green worker leave probability increases wage discrimination by 0.656 points, confirming high sensitivity to probability differentials.

H.2 Communication Parameter Effect

Coordination mechanism Section 3.10: $|w\_gap|\_communication = (1 - \delta)|w\_gap|\_individual$

Differentiate with Respect to δ $\partial|w\_gap|/\partial\delta = -|w\_gap|\_individual$

Substitute Observed Values $\partial|w\_gap|/\partial\delta = -17.64$ points per unit of coordination effectiveness

Calculate Observed Effectiveness $\delta\_observed = (12.89 - 9.75)/12.89 = 0.244$

Economic Interpretation: 1 unit increase in the effectiveness of coordination reduces discrimination by 17.64 points. The coordination at present achieves 24.4% of the maximum possible mitigation.

H.3 Gift Exchange Parameter Effect

Wage differential Section 3.8: $w\_Y* - w\_G* = -(1.333)/(15\beta\_1)$

Differentiate with Respect to β_1 $\partial(w\_Y* - w\_G*)/\partial\beta\_1 = (1.333)/(15\beta\_1^2)$

Calculate Elasticity $\varepsilon\_\beta 1 = (\beta\_1/|w\_gap|) \times \partial|w\_gap|/\partial\beta\_1 = -1$

Empirical Validation With $\beta\_1 = 0.061$, observed $wage\ gap = -17.64$: $\partial(w\_Y* - w\_G*)/\partial\beta\_1 = (1.333)/(15 \times (0.061)^2) = 23.9$

Economic Interpretation: 1% increase in the reciprocity parameter reduces discrimination by 1%. This provides evidence in support of the gift exchange as a partial mitigation channel.

H.4 Cross-Partial Effects

Leave Probability and Gift Exchange Interaction: $\partial^2(w\_Y* - w\_G*)/\partial\pi\_G\partial\beta\_1 = -(1.5)/(15\beta\_1^2(1 - \pi\_G)^2) = -107.5$

Economic Interpretation: Gift exchange becomes more effective at reducing discrimination when leave probabilities are higher, explaining stronger reciprocity among discriminated workers.