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Transportation Research Part A 141 (2020) 51–68

Contents lists available at ScienceDirect

Transportation Research Part A

journal homepage: www.elsevier.com/locate/tra

# A work-life conflict perspective on telework

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ARTICLE INFO

*Keywords:*
Telework
Work-life balance
Work-life conflict
Family life stages
Zero-inflated ordered probit regression
German Microcensus 2010

ABSTRACT

Telework has been promoted for decades as one of the traffic demand management policies to alleviate congestion during peak periods and reduce work-related trips, along with other benefits. However, less clear is the role played by life stages (i.e., gender, marital status and parenthood) on telework behavior. This study investigated to which extent telework frequency associated with life stages, and how these associations could be explained based on the work-life conflict perspective. Representative data were obtained from German Microcensus 2010 (N = 188,081 participants). The outcome variable was measured as ordered telework participation levels (i.e., never, infrequently and frequently). After testing for multicollinearity, a zero-inflated ordered probit regression model was applied to assess the associations between telework and family-life stages, while adjusting for individual, household, job-related and environmental characteristics. Results suggest that life stages associate with telework behavior in a complex way. Three patterns have been distinguished. Specifically, irrespective of gender and marital status, parents are less likely to telework compared to those without children. Regarding individuals without children, single individuals are more likely to telework than married ones, and males more likely than females. In contrast, for individuals with children, the partnered parents are more likely to telework than single parents, and females more likely than males. Our findings suggest that as the most important feature in family-life stages, children play a vital role in telework behavior. It not only increases both work-to-family conflict and family-to-work conflict, but also triggers housework re-division within couples and aggravates gender differences. Policies that support formal childcare resources could relieve the family-to-work conflict and encourage people to work at home.

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https://doi.org/10.1016/j.tra.2020.09.007
Received 8 October 2019; Received in revised form 21 July 2020; Accepted 7 September 2020
Available online 23 September 2020

## 1. Introduction

For decades, working from home (i.e., telecommuting, or teleworking) has been promoted as one of the traffic demand management policies, because of its potential to alleviate congestion during the peak periods (Asgari and Jin, 2018; Lachapelle et al., 2017; Shabanpour et al., 2018), reduce work-related trips[1] (Mokhtarian et al., 2004), and bring other benefits such as more work autonomy and morale, better work-life balance, and relieve of temporal and spatial constraints in daily activity schedules (Baruch, 2000; Pérez et al., 2002; Pendyala et al., 1991). Telework became mandatory for many employees during the outbreak of coronavirus disease in 2019 (COVID-19). The virus spread across the whole world, with more than 14 million confirmed infections and more than 600,000 deaths as of July 20, 2020 (Johns Hopkins CSSE, 2020). As an effective and necessary measure to control the COVID-19 pandemic, governments mandated self-isolation and stay-at-home policies. The COVID-19 pandemic has promoted telework as "an exogenous shock" (Aguilera et al., 2016), and it is possible that after the global health emergency many new teleworkers will continue to telework, at least part-time. Therefore, it became even more relevant to explore the theoretical foundations combined with an empirical analysis of telework to provide insights for future telework development.

Many empirical studies have investigated the associations between socio-demographic, work-related, environmental or commuting characteristics and telework behavior (i.e., option, choice and frequency) (Drucker and Khattak, 2000; Popuri and Bhat, 2003; Sener and Bhat, 2011; Singh et al., 2013). These studies confirmed that telework is strongly influenced by job characteristics, which may deprive employees' telework options, especially for manual and blue-collar workers (Asgari et al., 2014; Sener and Bhat, 2011; Singh et al., 2013; Walls et al., 2007). Moreover, telework is shaped by location-dependent factors, such as residential/job location and commuting distance/duration (Ellen and Hempstead, 2002; Kim, 2016; Kim et al., 2012; Ory and Mokhtarian, 2006), suggesting that individuals with long commutes tend to be more likely to choose telework (Ory and Mokhtarian, 2006; Sener and Bhat, 2011). However, little attention has been paid on the association between the family-life stage by gender (i.e., the three-way interaction of gender, marital status and parenthood) and telework choice/frequency. Although the relationships between telework and gender, marital status, and parenthood have been investigated in previous studies, they were mainly analyzed separately and led to contradicting conclusions. Some asserted that females, married individuals, and parents are more likely to telework (Asgari et al., 2014; Paleti, 2016; Popuri and Bhat, 2003; Sener and Bhat, 2011; Singh et al., 2013), while others found that they are less likely to telework (Drucker and Khattak, 2000; Popuri and Bhat, 2003; Sener and Bhat, 2011; Singh et al., 2013; Walls et al., 2007) (compare Literature Review). Although two-way interaction effects have been identified between gender and parenthood (Popuri and Bhat, 2003) and between marital status and parenthood (Drucker and Khattak, 2000), the three-way interaction of gender, marital status and parenthood (i.e., gendered family-life stage) has not been explored so far. Considering that previous findings have been mixed, it is important to study the interrelationship between the three factors. Therefore, it is necessary to investigate the full range of associations between the gendered family-life stage and telework in order to gain a more complete understanding of how telework behavior might differ across the life span.

Regarding the theoretical development in telework, at the macro level, theories such as organizational adaption, flexible working and knowledge economy attempt to explain the growth of telework based on the aggregated level of economic compositional changes (Felstead and Henseke, 2017). The evolutionary theory about telework stages defined by three critical dimensions (technology, location and organization) sheds new light on future telework development (Messenger and Gschwind, 2016). At the micro level, however, theories such as social exchange theory, border theory and role conflict theory have rarely been applied to explain the individual's telework behavior based on rigorous quantitative analysis (Felstead and Henseke, 2017; Holloway, 2007; Sirgy and Lee, 2016; Sullivan, 2012). The associations between telework and gender, marital status and parenthood, for example, suffer from the lack of systematic theoretical foundations. The effect of gender on telework adoption is interpreted from the gender-caused differences in job characteristics and telework options (Drucker and Khattak, 2000; Sener and Bhat, 2011), while children and marital status are explained from the household responsibility (Asgari et al., 2014; Drucker and Khattak, 2000; Popuri and Bhat, 2003; Sener and Bhat, 2011; Singh et al., 2013) (see Literature Review section). This indicates that a more unified theoretical frame is necessary to better understand the relationships between gendered family-life stage and telework.

In conclusion, there is a theoretical and empirical research gap with regard to the associations between telework behavior and gender, marital status and parenthood. The aims of this study are (1) to explore the full range of associations between gendered family-life stages and telework behavior, (2) to propose theoretical perspectives to these associations, and (3) to investigate to what extent the observed relationships could be explained based on the proposed theoretical perspective.

The rest of the paper is structured as follows. Section 2 gives a brief review of related studies and formulates research hypotheses. Section 3 describes the data and model design. Section 4 presents the model results and discussion. Finally, the overall conclusions of this study, limitations and strengths, policy implications and suggestions for future research are provided.

## 2. Literature review and research hypotheses

The literature review is structured into four topics. First, theories related to work-family interrelationship and telework are reviewed. Second, the empirical evidence of the relationship between work-life balance/conflict and telework are introduced, followed by a short overview of the relationship between the family-life stage and telework by gender. Fourth, an overview is given of how the

[1] Empirical evidence is inconclusive regarding the overall impact of telework on transportation (i.e., substitution or complementary travel) (Hamer et al., 1991; Kim et al., 2015; Melo and de Abreu e Silva, 2017; Mokhtarian et al., 2004; Zhu, 2012, 2013).

work-life balance/conflict changes due to family-life stage development by gender. At the end of this section, the theoretical assumptions and research hypotheses are proposed.

### 2.1. Telework related theories

The theories related to telework could be grouped into two streams, one pertains to the interrelationships between work and family life, and the other pertains to the interrelationships between employee and workplace (employer/organization/work outcome). We focus on the former part in this study.

#### 2.1.1. Work-life balance/conflict theories

There are many theories interpreting the relationships between work and family life. Among them, role theory, (inter)role conflict theory and boundary/border theory provide the basic terminology and perspectives to understand other theories (Frone, 2003; Morris and Madsen, 2007).

The **role theory** proposes that role is a set of duties, obligations and expectations that relate to the individual's position and status (Martin and Wilson, 2005). Individuals play multiple roles in their daily life (i.e., role accumulation). An individual can be an employee, a spouse and/or father/mother in his/her family-life domain at the same time. Different roles require different time and energy commitments. These role responsibilities in multiple life domains are often incompatible, which may lead to the inter-role conflict (Greenhaus and Beutell, 1985; Sirgy and Lee, 2016). The **(inter)role conflict theory** suggests that the work-life conflict takes three forms: time-based conflict, strain-based conflict and behavior-based conflict (Greenhaus and Beutell, 1985), and two directions: work-to-family conflict (WFC, work interfering with family) and family-to-work conflict (FWC, family interfering with work) (Gutek et al., 1991). In this perspective, telework is a compromising way to fulfill incompatible multiple roles demands, as it might mitigate one kind of conflict with the expense of increasing another.

The **boundary theory** (Ashforth et al., 2000) and **border theory** (Clark, 2000) focus on (a) different domains being segmented and integrated, (b) the boundary between them being created and maintained and (c) the detail process of role transition (i.e., boundary-crossing) between domains. Permeability and flexibility are two key concepts describing the role boundary. Permeability describes the degree by which elements of other domains take over (physically or psychologically) (Clark, 2000). Flexibility describes how far spatial and temporal boundaries are blurred (Ashforth et al., 2000). In the case of (home-based) telework, frequent interruptions from family members indicate high permeability of the (tele)work domain. The telework itself implicates the spatial flexibility of the work domain. If the teleworkers also have the autonomy to control their time schedules, it would represent high temporal flexibility. Compared with office work, the closer integration of work and family roles (characterized by high permeability and flexibility of telework) results in easier role transition but greater role blurring (Allen David et al., 2003).

The **spillover theory** asserts that the experiences or skills achieved from one domain (work or family) could be transferred to the other domain (family or work) (Staines, 1980). The spillover effect may be positive or negative, indicative similarity (e.g., in overall well-being, satisfaction) in both domains (i.e., isomorphism). The positive spillover is also known as **work-family enrichment theory** (Greenhaus and Powell, 2006). The high permeable boundary in telework could render the (both positive and negative) spillover process easier than conventional work (cf. Proposition 3 in Standen et al. (1999) for the positive spillover example). On the other hand, the **compensation theory** suggests an inverse relationship between work and family domains (i.e., dissimilarity or heteromorphism) and explains that individuals would devote more time and energy into one domain (e.g. work) to compensate the dissatisfaction from other domain (e.g. family) (Frone, 2003; Morris and Madsen, 2007; Staines, 1980). The **accommodation theory** asserts the same inverse association between work and family domains but with an opposite causal process. For example, workers might curb their work involvement to better accommodate their family responsibilities (Lambert, 1990). Besides, both theories pertain to the **resource drain theory**, which states that the individual's resources (e.g. time, energy or attention) are finite, the more they are spent in one domain (e.g. work), the less they can be used in another domain (e.g. family) (Frone, 2003; Morris and Madsen, 2007).

The **congruence theory** posits that the association between work and family domain is spurious by a third variable (Frone, 2003; Morris and Madsen, 2007). For example, telework might attenuate or improve well-being in both work and family domains simultaneously (cf. Proposition 1 and 2 in Standen et al. (1999)). Finally, the **segmentation theory** postulates that the work and family are segmented and independent from each other (Frone, 2003; Morris and Madsen, 2007). The psychological disengagement promotes that individuals actively keep their work and family domains separate (Lambert, 1990), such as commuting for conventional work, and that the boundary-building strategy sets a clear demarcation for workspace at home for telework (although the psychological disengagement is harder for teleworkers) (Standen et al., 1999).

Another emerging perspective to understand the interrelationship between work and non-work domains is the integrated concept of work-life balance (WLB), which is defined as "an overall appraisal of the extent to which individuals' effectiveness and satisfaction in work and family roles are consistent with their life values at a given point in time" (Greenhaus and Allen, 2011, p. 174). While earlier studies viewed it in terms of low degree of role conflict and high degree of role enrichment (Frone, 2003), recently the work-life balance is taken as a unique concept and measurement, which is, in essence, theoretically and psychometrically distinct from conflict and enrichment (Allen, 2012; Carlson et al., 2009).

#### 2.1.2. Summary

Telework research has benefited a lot from multiple theories derived from sociology and social psychology. However, the previous applications of those theories are immersed in the impact of telework, paying little attention to the telework behavior itself.

Also, those theories are not exclusive from each other. Many of them are supported by emipircal evidences (Byron, 2005; Lambert,

1990; Staines, 1980). For example, the role conflict theory, the resource drain theory, the compensation theory and the congruence theory are supported simultaneously in Michel et al. (2011). This confirms that no single theory captures all the processes that link work/family life and telework.

### 2.2. Work-life balance/conflict and telework

Work-life balance has been identified as one of the main drivers of telework (Haddad et al., 2009; Mokhtarian and Salomon, 1997), with the intent that telework improves the work-life balance at least to some extent. Below, both the impact of work-life balance on telework and the impact of telework on work-life balance are discussed.

Several studies have examined the influence of work-life balance on telework. For example, Mokhtarian and Salomon (1997) concluded that family-related factors as an important driver for telework. Moreover, research from Haddad et al. (2009) indicated that other family members may appreciate the employee teleworking, which could be a strong driver for an employee to telework. However, other researchers (Aguilera et al., 2016; Tremblay et al., 2006) pointed out that better work-life balance is not a motivation to telework for most individuals who choose to do so.

On the other hand, many studies investigate the impact of telework on work-life balance/conflict, though their results are inconclusive. Some believe that telework perils the work-life balance. For example, Noonan and Glass (2012) found that telework did not help to achieve a better work-life balance, but that it strengthened the ability of employers to increase employees' work demands. Russell et al. (2009) also confirmed that telework would increase work pressure and deteriorate work-life balance, as it not only increases working hours but also blurs the work and life domain, which may cause the intrusion of work into family life. Others believe that telework is conducive to work-life balance. For example, Maruyama et al. (2009) found that the work-life balance could be improved by telework. Wheatley (2012) reported teleworkers with higher satisfaction toward working hours and job as well as the amount and use of leisure time.

The inconclusive results could be attributed to several biases. First, there is the measurement inconsistency. Studies interested in the influence of work-life balance on telework are unable to measure the work-life balance per se. Instead, proxy statements are used in questionnaires, such as "To what extent is the work-life balance (or family obligations) the reason to telework?". Studies interested in the influence of telework on work-life balance/conflict commonly focus on psychometrically sound measurements of work-life conflict rather than work-life balance (Carlson et al., 2009). The two research branches traditionally diverge from each other and ignore the mutual relationship. For example, the effect of telework on work-life balance identified in Russell et al. (2009) might be undermined by the fact that (in their sample) telework is most common among men with young children, who happen to be more likely to suffer from work-life conflict, which might act as a driver rather than a consequence of telework.

Furthermore, some moderating factors might have been missed in previous research, such as telework frequency (Sullivan, 2012). Maruyama et al. (2009) revealed that compared to infrequent teleworkers, frequent teleworkers are more likely to report positive work-life balance. The meta-analysis by Gajendran and Harrison (2007) also indicated that frequent telework could mitigate the work-life conflict, while the influence of infrequent telework is less evident. Finally, previous research rarely considered the bidirectional characteristic of work-life conflict. Golden et al. (2006) pointed out that frequent telework would help to reduce individuals' work-to-family conflict, but increase their family-to-work conflict[2]. The asymmetric impacts of telework on the WFC/FWC also implicate that individuals sometimes might have to trade off between the WFC and FWC when considering telework as a means to improve the overall work-life balance.

### 2.3. Family-life stage and telework by gender

Although several studies investigated the association between telework choice/frequency and gender, marital status and children, few of them considered the relationship between family-life stage by gender and telework specifically. Moreover, the results achieved by previous studies are inconclusive. The details are shown in Table 1.

Some studies found that females, married and parenthood were positively associated with telework (Asgari et al., 2014; Paleti, 2016; Popuri and Bhat, 2003; Sener and and Bhat, 2011; Singh et al., 2013), while others indicated the negative associations (Drucker and Khattak, 2000; Popuri and Bhat, 2003; Sener and Bhat, 2011; Singh et al., 2013; Walls et al., 2007). As to interaction between the three features, two-way interaction effects have been identified between gender and parenthood (Popuri and Bhat, 2003), and between marital status and parenthood (Drucker and Khattak, 2000; Jin and Wu, 2011). Drucker and Khattak (2000) found that single individuals without children were more likely to telework than married individuals without children, which is confirmed by the descriptive results of NPTS 1995 and NHTS 2001 in Jin and Wu (2011). Furthermore, Jin and Wu (2011) also found that single adult households with children were less likely to telework than multi-adult households with children, especially, single adult households with younger children aged 0–5 years were least likely to telework compared with all other life stages. Popuri and Bhat (2003) found that females were less likely to telework than males in the household without children, while more likely to telework than males in the household with children.

More importantly, these inconsistent results were explained in a similar way. For example, the effect of gender on telework

[2] Telework frequency was measured by the proportion of working hours at home (0–40%, 41–70%, 71–90%, and 91–100%) in Maruyama et al. (2009), by low intensity (fewer than 2.5 days per week) and high-intensity (2.5 or more days per week) in Gajendran and Harrison (2007), and by telework hours per week in Golden et al. (2006).

**Table 1**
The Effects of Gender, Marital Status and Children on Telework Choice and Frequency.

| Studies | Area | Dataset | Method | Female | Marital status | Children |
|---|---|---|---|---|---|---|
| Deming (1994) | U.S. | CPS[1] 1991 | Descriptive | + | + | + |
| Jin and Wu (2011) | U.S. | NPTS[2] 1995 NHTS[3] 2001, 2009 | Descriptive | – | *Mixed (interaction with children)* | *Mixed (interaction with marital status)* |
| Noonan and Glass (2012) | U.S. | CPS 1997, 2001, 2004 NLSY[4] 1998, 2002, 2004 | Descriptive | Mixed | + | + |
| Drucker and Khattak (2000) | U.S. | NPTS 1995 | Ordered Logit, Ordered Probit, Multinomial logit (MNL) models[9] | – | *Mixed (interaction with children)* | *Mixed (interaction with marital status)* |
| Popuri and Bhat (2003) | New York, U.S. | RT-HIS[5] 1997/8 | Joint model (choice) | – | + | *+ (interaction with female)* |
| | | | Joint model (frequency[10]) | NS | + | *+ (interaction with female)* |
| Peters et al. (2004) | Netherlands | Work & IT 2001 survey | Multivariate analysis (choice) | NS | NS | NS |
| Walls et al. (2007) | Southern California, U.S. | SCAG[6] Telework Survey 2002 | Standard Probit Model (choice) | NS | NC | – |
| | | | Ordered Probit Model (frequency[11]) | NS | NC | NS |
| Tang et al. (2008) | Northern California, U.S. | Self-administered Survey 2003 | Multinomial logit model (choice-frequency[12]) | NS | NC | NS |
| Sener and Bhat (2011) | Chicago, U.S. | CRHTI[7] 2007–2008 | Joint model (choice) | – | NC | + |
| | | | Joint model (frequency[13]) | NS | NC | NS |
| Singh et al. (2013) | San Francisco Bay area, U.S. | NHTS 2009 | Option-Choice-Frequency Joint model (choice) | + | *NS (interaction with female)* | + |
| | | | Option-Choice-Frequency Joint model (frequency[14]) | NS | *NS (interaction with female)* | – |
| Asgari et al. (2014) | New York, U.S. | RHTS[8] 2010–2011 | Binary Probit Model (choice) | NS | NC | + |
| | | | Ordered Probit Model (frequency[15]) | + | NC | *Mixed (interaction with household adults number)* |
| Paleti (2016) | U.S. | NHTS 2009 | Generalized Extreme Value models, Random Utility Models (frequency[16]) | + | NC | *NS (interaction with female)* |

+: Positive relationship with telework choice or frequency.
–: Negative relationship with telework choice or frequency.
NC: not considered in the research.
NS: not significant in the research.
Mixed: both positive and negative relationship with telework choice or frequency estimated.

[1] CPS: special supplements from the Census Current Population Survey (CPS).
[2] NPTS: Nationwide Personal Transportation Survey. NPTS has been conducted in 1969, 1977, 1983, 1990, and 1995, thereafter, it is updated by NHTS.
[3] NHTS: National Household Travel Survey, which was conducted in 2001, 2009 and 2017.
[4] NLSY: National Longitudinal Survey of Youth.
[5] RT-HIS: Regional Transportation Household Interview Survey.
[6] SCAG: Southern California Association of Governments.
[7] CRHTI: Chicago Regional Household Travel Inventory.
[8] RHTS: Regional Household Travel Survey.
[9] Frequency category: never, infrequent (at least once per month but less than once per week), frequency (at least once per week).
[10] Frequency category: number of days of telework per week.
[11] Frequency category: infrequent (0–1 day/week), medium (2–3 days/week), and high (≥4 days/week).
[12] Frequency category: 0 day/month, 1 day/month, 2–4 days/month, 5–8 days/month, ≥9 days/month.
[13] Frequency category: 'once a year', 'a few times a year', 'once a month or more', 'once a week or more', and 'almost every day'.
[14] Frequency category: actual count of telework frequency per month.
[15] Frequency category: low (number of telecommuting hours is equal to or less than 25% of the total number of work hours), medium (number of telecommuting hours is less than 65% but greater than 25% of the total number of work hours), and high (number of telecommuting hours is 65% or more of the total number of work hours).
[16] Frequency category: actual count of telework frequency per month. The models they examined include: Poisson Model, Geometric Model, Negative Binomial (NB) Model, MNL Model, zero inflated NB (ZINB), hurdle NB, Ordered GEV Model, MNL with additional utility terms (MNL FLEX) Models, OGEV FLEX Models.

adoption is interpreted from the gender-related job differentials, such as that males occupy jobs with 'more autonomy and bargaining power', and/or requiring telework expertise (Drucker and Khattak, 2000; Sener and Bhat, 2011). The effect of children is explained by that individuals with children would commit more to household responsibilities (Asgari et al., 2014; Drucker and Khattak, 2000; Popuri and Bhat, 2003; Sener and Bhat, 2011; Singh et al., 2013). Among them, Singh et al. (2013) mentioned that children may also

cause distractions for work and result in a negative effect on telework frequency. Finally, Popuri and Bhat (2003) considered that married individuals are under more family obligations than their single counterparts.

While in the present study, it is worthwhile to take a more unified gendered family-life stage frame to understand the relationships between gender, marital status, children and telework. It should be clarified that it is a complement rather than a substitution of other explanations such as gender-related occupational differentials.

### 2.4. Family-life stage and work-life balance/conflict by gender

The impact of family-life stage on individuals is different by gender (Scheiner, 2014). For example, Wepfer et al. (2015) found that the demands in work and domestic domains are highly dependent on the interaction of family-life stages and gender, with women experiencing more family caregiving responsibilities than men, while men experience more work pressure during their primary child-rearing family-life stages, regardless of the level of employment. Similarly, a study of German work-life balance also confirmed the gender difference by pointing out that men spend about half the amount of hours in domestic work per week compared to women (Arthur, 2002). Moreover, the traditional housework division by gender (where females take on more childcare and housework while males focus more on employed work) becomes stronger after childbirth (Scheiner, 2014). One German study found that the gender-specific differences increase with the childcare intensity (defined by age of youngest children, with a higher intensity corresponding to younger age) (Bauer et al., 2007). This gendered division becomes consolidated instead of weaker as the children grow older (Grunow et al., 2012).

In spite of those evident role demands and time use discrepancies related to family-life stage by gender, work-life balance is not fluctuating across the family-life stage (Wepfer et al., 2015). Except for the empty nest stage (participants aged 55 or more, without children living at home, which pertains to the highest work-life balance), all family-life stages show a similar level.

In contrast, the work-life conflict (for both WFC and FWC) is highly related to the work and family role demands across the family-life stage by gender, resulting in a curvilinear relationship between work-life conflict and family-life stage[3] (Erickson et al., 2010). In detail, both the WFC and FWC increase significantly as workers change into their parenthood stage, being the highest when their youngest children aged 6–12 years (for WFC) and 2–5 years (for FWC), respectively. They decrease when their youngest children grow up, and become the lowest in the empty nest stage (Erickson et al., 2010). Based on the same sample and measurements, another research delineates the gender difference in this process (Martinengo et al., 2010). Specifically, the WFC for males is higher than for females across all family-life stages. This biggest discrepancy is found when the youngest children are under 6 years old. The discrepancy narrows down as the youngest children grow up, and diminishes in the empty nest stage (Martinengo et al., 2010). The FWC is similar for males and females before they have children, while females' FWC becomes higher than males' FWC as they change into the parenthood stage, and the largest discrepancy is found, rather surprisingly, in the empty nest stage (Martinengo et al., 2010).

Although the concept of family-life stages or life cycle stages has been used to investigate how the work-life balance change over different life courses (Erickson et al., 2010; Wepfer et al., 2015), these studies only covered typical family-life stages. For example, single males or females older than 35 years were excluded in Wepfer et al. (2015)'s family-life stage categories, and individuals between aged 35 to 50 years without children were not included in Erickson et al. (2010)'s research because of their ambiguity of life stage characteristics. Furthermore, single parents were not covered in either of them. Therefore, we considered it to be of great value to operationalize a family-life stage variable by gender that includes all population groups, in contrast to previous research that excluded some population groups.

### 2.5. Theoretical assumption and research hypotheses

#### 2.5.1. Theoretical perspective

This study aims to explore the associations between gendered family-life stages and telework behavior based on both empirical analyses and theoretical foundations. Theoretically, work-life balance is a convenient perspective as it is frequently suggested to be one important driver for telework. However, our review showed that this alleged telework driver is based on the work-life balance's colloquial meaning and not on its stricter academic definition. Therefore, we propose the work-life conflict perspective in this study.

While empirical evidence indicates a structural change of work-life conflict contingent on the gendered family-life stage, the work-life balance does not associate with the family-life stage (Bennett et al., 2017; Blanchard-Fields et al., 1997; Erickson et al., 2010; Martinengo et al., 2010). This enables the gendered family-life stage as a proxy of the work-life conflict. It also provides the additional advantage of avoiding the endogenous problem between the work-life conflict and telework (as they mutually influence each other as we argued in Section 2.2), as the family-life stage is not changed by telework.

In addition, the work-life conflict perspective provides multiple theories for the analysis. For example, the role demand change with the family-life stage development can be easily explained as the shared expectations change along with the role position and status change in the social structure (Martin and Wilson, 2005). Also, the role demand change indicates the boundary/border restructure

[3] In the research of Erickson et al. (2010) and Martinengo et al. (2010), the WFC measurement only covers the time-based conflict, and the FWC measurement only covers the strain-based conflict. The family-life stage consists of six categories: before children (workers aged 35 years or less without children), transition to parenthood (only one child 1-year-old or less), preschool-age child (youngest child 2–5 years), school-age child (youngest child 6–12 years), adolescent child (youngest child 13–17 years), and empty nest stage (workers aged 50 years or more without children living at home).

between work and family life domains based on the boundary/border theory (Ashforth et al., 2000; Clark, 2000). Especially, the resource drain theory claims that children (especially young children) consume more resources from their caregivers. The depletion of available resources makes it harder to deal with multiple role demands, leading to stronger work-life conflicts (Michel et al., 2011). Besides, the role conflict theory differentiates the work-life conflict into WFC and FWC and explains how gender roles perceive them differently (Gutek et al., 1991).

As summarized in Section 2.1, however, these theories are interested in the work-life conflict consequence (how the family-life stage development, role demand change, etc., influence WFC and FWC), instead of how individuals trade off between these conflicts they encountered. In this regard, the accommodation theory is quite insightful in seeing the work-life conflict as a consequence of individuals actively choosing which domain and role they are willing to devote to (Lambert, 1990). According to the role theory, however, this active "willingness" is constrained by the social structure and culture within which individuals internalize the shared expectations of the roles they perform. For example, the traditional gender role expectations may push females to "willingly" devote more to family responsibilities while males "willingly" devote more to their career development. The underlying statement is that they might encounter much more implicit conflicts if they are not "willing" to choose to do so (cf. the example of career females and males at home in Gutek et al. (1991)). Thus, we assume that how many resources individuals devote their daily work and family life is a consequence of the trade-off between different conflicts (e.g., the explicit and implicit conflicts, the WFC and FWC) and how they choose the conflicts they endure. With the capability of influencing WFC and FWC, telework could be a competitive strategy worthy of consideration for individuals to reconcile their incompatible roles in work and family domains.

#### 2.5.2. Research hypotheses

Based on the above information, especially the findings of Golden et al. (2006), telework could be regarded as a mean of trade-off between work-to-family conflict and family-to-work conflict. It would be plausible to assume that individuals are more likely to telework if they would like to reduce work-to-family conflict with the cost of increasing family-to-work conflict.

Besides, according to previous research (Allen and Finkelstein, 2014; Bennett et al., 2017; Martinengo et al., 2010; Mennino and Brayfield, 2002), males tend to put more commitment towards work and tend to be more tolerant towards the encroachment on the family domain by work. Females, on the other hand, tend to put more concern and commitment towards family obligations and tend to be less likely to let work interfere with their family life. This is especially the case when the work-family conflict is driven by childcare and the housework diverges by gender (Erickson et al., 2010; Grunow et al., 2012; Wepfer et al., 2015).

We therefore hypothesized that (1) males are less likely to telework once they encounter family-to-work conflict, which is usually the situation when they are married or have children, (2) females, in contrast, are more likely to telework once they experience an increased work-to-family conflict, which is often observed when they are married or have children (especially 0–5 years old children).

Based on the research of Bauer et al. (2007), former West Germany is distinct from former East Germany in several dimensions. For example, former West Germany has less public support in childcare compared to former East Germany, and employees spend less time in formal work and more time in informal work, which is especially true for females (Bauer et al., 2007). We assume that these differences would be significant enough to have an impact on telework behavior, and therefore hypothesize that (3) employees in former West Germany are more likely to telework than in former East Germany.

## 3. Methodology and data

### 3.1. Data source and sample

Data were obtained from the "German Microcensus 2010" (Statistical Offices of the Federation and the Federal States, 2018), which is the official statistic of the population and the labor market in Germany, with a representation of one percent of all households. The sample selected for this study only included individuals who are employed (N = 229,236 individuals), participants who work abroad, in the armed forces occupations, or as alternative civilian service[4] were excluded (N = 10,983 individuals). Individuals with missing values were also excluded from the analysis (N = 30,172). Finally, 188,081 individuals remained for the final analysis, which is representative of the German working population. We used the weights provided at the German Microcensus 2010. The weights were adjusted for gender, age groups and employment status within each federal state without considering the household context. As a result, household members may not have the same weight but may slightly vary.

### 3.2. Outcome variable

Regarding the participant level of telework, the participants were asked "Did you work at home in the last 3 months?". The answer to this question was measured as an ordered discrete response with three options: "Mainly (at least half of the working time)", "Sometimes" and "Never". Accordingly, based on the proportion of working hours at home, we categorized our outcome variable telework into three participation levels, i.e., "Frequently" for 50–100% of working time at home, "Infrequently" for less than 50% of working time at home, and "Never" for did not work at home at all.

[4] The German term "Zivildienst" also translates into "compulsory community service" or "civilian service", was the alternative service to military service before conscription was suspended for peacetime in 2011.

### 3.3. Family-life stage and control variables

Independent variables were classified as individual characteristics, household characteristics, job characteristics and environmental characteristics. To operationalize the family-life stage by gender for all population groups, this study classified the family-life stage into 16 categories for all individuals based on gender, marital status and youngest children[5] (without children, or with children aged 0–5, 6–17, and 18 and older).

Control variables were selected based on previous studies, including individual and household characteristics, job-related characteristics and environmental characteristics.

### 3.4. Methodology

First, the independent variables were tested for multicollinearity. Pearson correlation coefficients were used for continuous variables (household employment ratio, seniority and working hour), Eta square coefficients were applied between continuous variables and categorical variables, and Cramer's V was used for categorical variables (see supplementary material Table 1). As all the correlation coefficients were less than 0.7, all variables were considered in this analysis (Freedman et al., 1991).

Then, the dependent variable is severely unbalanced with more than 87% of individuals who do not telework at all. Those who do not telework at all can be separated into two different parts: individuals without telework options and individuals with telework options but who chose not to work at home. Therefore, the zero-inflated ordered probit (ZIOP) regression models were used to estimate the telework choice. As the telework option is decided by the employers, the zero-inflation part of the ZIOP model was assumed to be determined by job type in this study.[6]

To investigate whether considering the family-life stage by gender improves the current model fit, and to which extent the work-life conflict perspective helps to understand the telework behavior, two models were designed: Model 1 includes gender, marital status and children. Model 2 includes the family-life stage represented by the full interaction of gender, marital status and children. Both models are controlled by the individual, household, environmental and job characteristics. The models' goodness-of-fits were compared with the Akaike information criterion (AIC) and the Bayesian information criterion (BIC). The model with the smaller AIC and BIC is preferred.

Furthermore, similar to all discrete choice models, as the estimated parameters of ZIOP models cannot directly quantify the absolute likelihood of teleworking compared to a reference group, the average marginal effects are used for better interpretations. All the estimations are carried out using Stata SE 15.1.

## 4. Results and discussion

### 4.1. Descriptive analysis

The descriptive statistics for the total sample as well as the subsample of teleworks were presented in the supplementary material Table 2. Overall, the average age of participants is 41.95 years, 53.53% are male. Most people aged 35 and older (70.49%). About 12.85% of participants engage in teleworking (infrequently or frequently) with weighted records. Among teleworkers, 74.15% telework infrequently (sometimes), while 59.23% are male. 62.12% of teleworkers have a higher education level, indicating that people with higher education levels may have a more flexible choice to work at home (Singh et al., 2013). Most teleworkers are in service industries (59.07%), non-manual employees (42.71%), self-employed/family-workers (39.02%), government officials, judges or teachers (14.66%). The distributions of telework over industries and occupations are consistent with previous findings (Mateyka et al., 2012).

Regarding the family-life stage (Fig. 1), more married men without children engage in teleworking (14.6%) (stage 5) than married women without children (9.45%) (stage 13). A similar situation is found for single males/females without children (16.68% for stage 1, compared to 11.35% for stage 9). The share of married parents is smaller in the total sample than among teleworkers (except for stage 16). For example, 9.08% of the total sample is a married male with children 6–17 years (stage 7), while they account for 11.97% of teleworkers. On the other hand, the share of single parents in the total sample is larger than that in teleworkers. For example, single males/females with children older than 18 years account for a larger share in the total sample (4.88% and 3.79% for stage 4 and 12 respectively) than in teleworkers (2.07% and 1.8% for stage 4 and 12, respectively).

[5] The classification is based on two considerations. One is the classifications in other researches. Erickson et al. (2010) classified the youngest children into 0–1 years (transition to parenthood), 2–5 years (preschool child), 6–12 years (school-age child) and 13–17 years (adolescent child). Bennett et al. (2017) classified the youngest children into 0–5 years, 6–12 years, 13–18 years and 18+ years. Another consideration is the situation in Germany. The compulsory school age in Germany is 6 years. Although children are entitled to kindergarten starting at age 3 (OECD, 2006), it is not compulsory. So, it is not applied in this study. Therefore, we merged children of 0–1 years and 2–5 years into one category, because they both are preschool children and need intense attention from their parents. We also merged the school-age child stage and adolescent child stage into one category to avoid categories with too few records.

[6] Only two job type related variables, Industrial group and Profession, are considered to influence telework option in this study, other alternatives are also considered and the results shown in supplementary material Table 6.

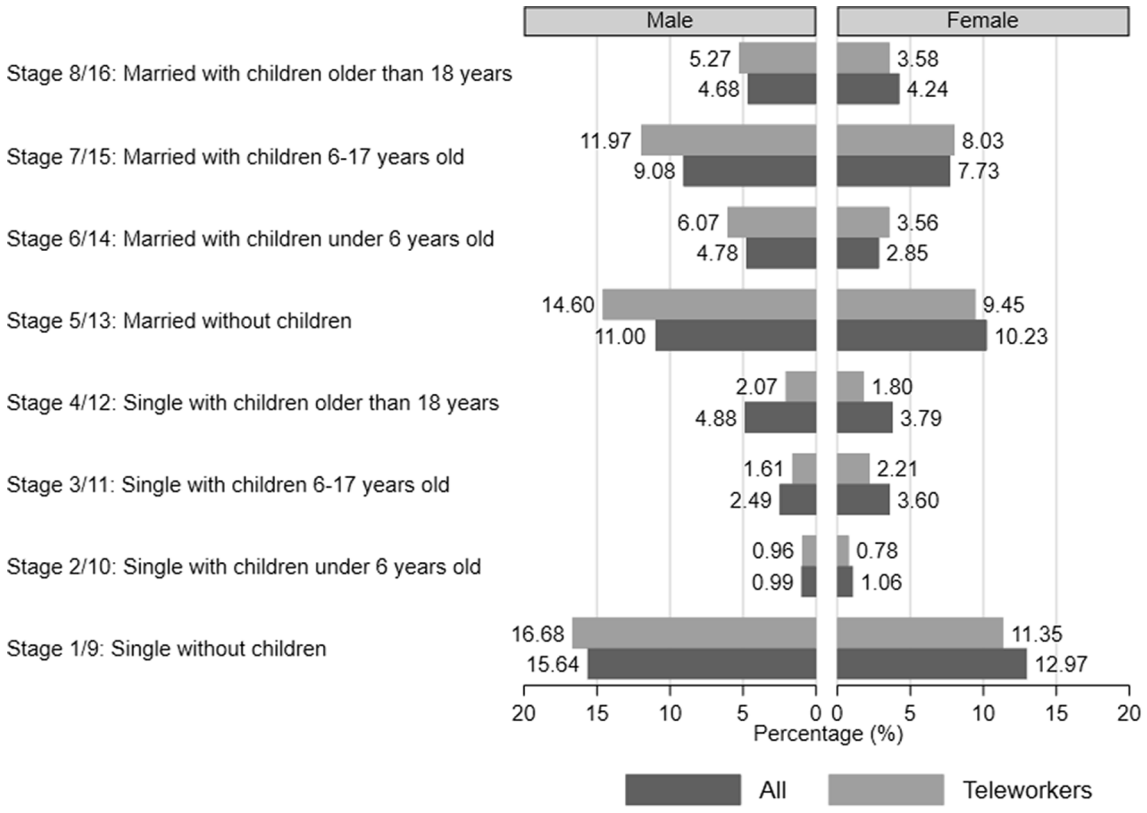


**Fig. 1.** Distribution of family-life stage by gender for all samples and for teleworkers. Notes: Stages 1-8 for males, stages 9-16 for females. For example, stage 1 represents a single male without children, stage 9 represents a single female without children. The figure only includes employed individuals who are not working abroad, in the armed forces, or as alternative civilian service and without missing values. The total sample is 188,081, with 24,467 teleworkers (12.85% after applying weights). *Source:* Authors' calculations based on the German Microcensus 2010.

### 4.2. Model results

As shown in Table 2, including family-stage (model 2) improves the model fit based on the AIC and BIC scores. Furthermore, to better interpret the results, the average marginal effects of each variable on the telework frequency are calculated based on model 2 (see supplementary material Table 3). Based on the results of Table 2, individuals are more likely to have the telework option if they work in service industries. This is reasonable as jobs in other industries (e.g., manufacturing, trade, transport and communication) require more on-site work. Compared to other workers, non-manual employees, self-employed/family-workers, government officials, judges or teachers are more likely to have telework options. This was consistent with previous findings that employees in professional, managerial or technical occupation categories are more likely to have the telework option[7] (Singh et al., 2013).

#### 4.2.1. Family-life stages and work-life balance by gender

Regarding gender-specific family-life stages (model 2), three patterns could be classified in general based on the average marginal effect results (Fig. 2). **Pattern one** indicates that, irrespective of gender and marital status, individuals with children (stages 2–4, 6–8, 10–12, 15–16) are less likely to telework than their counterparts without children (stages 1, 5, 9, 13). On the other hand, married females with children aged 0–5 years (stage 14) are more likely to telework than married females without children (stage 13). This is contrary to the pervasive assumption that the presence of children in the household would increase the likelihood to telework as it produces inevitable childcare responsibility (Asgari et al., 2014; Drucker and Khattak, 2000; Popuri and Bhat, 2003; Sener and Bhat, 2011; Singh et al., 2013). However, this result (i.e., entering parenthood reduce the likelihood to telework) is not as surprised as it was first found by Walls et al. (2007) for telework choice and then by Singh et al. (2013) for telework frequency. This finding implicates that, the increased household demand caused by children would increase not only the work-to-family conflict as normally expected, but also family-to-work conflict (for example, cause distractions for work), which is neglected in most previous studies. The results also implicate that individuals who experience high levels of work-to-family and family-to-work conflicts simultaneously (Erickson et al.,

[7] Note that the absence of a unified measurement of the industry/occupation type makes the comparison across studies difficult. For example, The occupation type in Singh et al. (2013) based on NHTS is actually a mixture of industry and job type (cf. footnote 7 on page 385 in their study).

**Table 2**
ZIOP regression model results for telework choice based on individual, household, environmental and job characteristics.

| Variables | Model 1: independently | | Model 2: family-life stages | |
|---|---|---|---|---|
| | Coefficient | Standard error | Coefficient | Standard error |
| ***Individual characteristics*** | | | | |
| Age < 35 (ref. = 'Age>=35') | −0.150*** | −0.01 | −0.142*** | −0.01 |
| Male (ref. = Female) | 0.043*** | −0.01 | NC | NC |
| Single (ref. = Married/partner) | −0.005 | −0.01 | NC | NC |
| **Children** (ref. = Youngest children older than 18 years) | | | | |
| No children | 0.235*** | −0.02 | NC | NC |
| Youngest children under 6 years old | 0.148*** | −0.02 | NC | NC |
| Youngest children 6–17 years old | 0.103*** | −0.02 | NC | NC |
| **Family-life stage** (ref. = Stage 1, Single male without children) | | | | |
| Stage 2, Single male with children under 6 years old | NC | NC | −0.264*** | −0.05 |
| Stage 3, Single male with children 6–17 years old | NC | NC | −0.200*** | −0.04 |
| Stage 4, Single male with children older than 18 years | NC | NC | −0.465*** | −0.04 |
| Stage 5, Married male without children | NC | NC | −0.101*** | −0.02 |
| Stage 6, Married male with children under 6 years old | NC | NC | −0.215*** | −0.03 |
| Stage 7, Married male with children 6–17 years old | NC | NC | −0.236*** | −0.02 |
| Stage 8, Married male with children older than 18 years | NC | NC | −0.267*** | −0.03 |
| Stage 9, Single female without children | NC | NC | −0.115*** | −0.02 |
| Stage 10, Single female with children under 6 years old | NC | NC | −0.256*** | −0.05 |
| Stage 11, Single female with children 6–17 years old | NC | NC | −0.319*** | −0.03 |
| Stage 12, Single female with children older than 18 years | NC | NC | −0.442*** | −0.03 |
| Stage 13, Married female without children | NC | NC | −0.139*** | −0.02 |
| Stage 14, Married female with children under 6 years old | NC | NC | −0.118*** | −0.03 |
| Stage 15, Married female with children 6–17 years old | NC | NC | −0.213*** | −0.03 |
| Stage 16, Married female with children older than 18 years | NC | NC | −0.255*** | −0.03 |
| **Nationality** (ref. = Others) | | | | |
| German | 0.059* | −0.02 | 0.059* | −0.02 |
| **Educational level** (ref. = High) | | | | |
| Low educational level | −0.780*** | −0.03 | −0.771*** | −0.03 |
| Middle educational level | −0.545*** | −0.01 | −0.543*** | −0.01 |
| ***Household characteristics*** | | | | |
| HH employment rate | −0.139*** | −0.03 | −0.188*** | −0.03 |
| **Household income** (ref. = High) | | | | |
| Low HH income (0–2600 Euro) | −0.431*** | −0.02 | −0.438*** | −0.02 |
| Middle HH income (2600–5000 Euro) | −0.287*** | −0.01 | −0.288*** | −0.01 |
| **House ownership** (ref. = The main tenant or subtenant) | | | | |
| Owner of the building or apartment | 0.057*** | −0.01 | 0.064*** | −0.01 |
| ***Environment*** | | | | |
| **Workplace and home location** (ref. = In different states) | | | | |
| In the same state | −0.059** | −0.02 | −0.063*** | −0.02 |
| **Workplace** (ref. = West Germany) | | | | |
| East Germany | −0.337*** | −0.01 | −0.334*** | −0.01 |
| **Municipality size** (ref. = Large) | | | | |
| Small: Less than 20,000 inhabitants | −0.075*** | −0.01 | −0.070*** | −0.01 |
| Medium: 20,000 to less than 500,000 inhabitants | −0.065*** | −0.01 | −0.062*** | −0.01 |
| ***Job characteristics*** | | | | |
| Seniority | −0.008*** | 0.001 | −0.008*** | 0.001 |
| Working hours | 0.001** | 0.001 | 0.002*** | 0.001 |
| **Industrial group** (ref. = Services) | | | | |
| Agriculture, forest, fisheries | 0.865*** | −0.05 | 0.872*** | −0.05 |
| Manufacturing, industry | −0.085*** | −0.01 | −0.085*** | −0.01 |
| Trade, transport and communications | −0.041** | −0.01 | −0.040** | −0.01 |
| **Profession** (ref. = Student. Retiree) | | | | |
| Non-manual employee, white collar worker | −1.603*** | −0.11 | −1.620*** | −0.11 |
| Manual employee, blue collar worker | 0.101 | −0.17 | 0.084 | −0.17 |
| Self-employed or unpaid family worker | −0.193 | −0.11 | −0.211 | −0.11 |
| Officials, judges, teachers | −0.930*** | −0.11 | −0.949*** | −0.11 |
| Commercial/Technical/Industrial apprentice | −0.943*** | −0.23 | −0.950*** | −0.23 |
| **Additional job** (ref. = Yes) | | | | |
| No, no additional job | −0.203*** | −0.02 | −0.204*** | −0.02 |
| **Firm size** (ref. = 50 or more employees) | | | | |
| 1–10 employees | 0.278*** | −0.01 | 0.278*** | −0.01 |
| 11–49 employees | 0.069*** | −0.01 | 0.068*** | −0.01 |
| **Saturday work** (ref. = No or occasionally) | | | | |
| Constantly or regularly | −0.222*** | −0.02 | −0.222*** | −0.02 |
| **Sunday work** (ref. = No or occasionally) | | | | |
| Constantly or regularly | 0.260*** | −0.02 | 0.258*** | −0.02 |
| **Evening work** (ref. = No or occasionally) | | | | |

(*continued on next page*)

**Table 2** (*continued*)

| Variables | Model 1: independently | | Model 2: family-life stages | |
|---|---|---|---|---|
| | Coefficient | Standard error | Coefficient | Standard error |
| Constantly or regularly | 0.265*** | −0.01 | 0.264*** | −0.01 |
| **Night work** (ref. = No or occasionally) | | | | |
| Constantly or regularly | −0.570*** | −0.03 | −0.571*** | −0.03 |
| ***Inflate*** | | | | |
| **Industrial group** (ref. = Services) | | | | |
| Agriculture, forest, fisheries | −0.032 | −0.06 | −0.032 | −0.06 |
| Manufacturing, industry | −0.192*** | −0.03 | −0.191*** | −0.03 |
| Trade, transport and communications | −0.226*** | −0.03 | −0.228*** | −0.03 |
| **Profession** (ref. = Student, Retiree) | | | | |
| Non-manual employee, white collar worker | 7.485*** | −0.07 | 7.522*** | −0.07 |
| Manual employee, blue collar worker | −1.160*** | −0.08 | −1.165*** | −0.08 |
| Self-employed or unpaid family worker | 1.551*** | −0.07 | 1.540*** | −0.07 |
| Officials, judges, teachers | 7.736*** | −0.08 | 7.759*** | −0.09 |
| Commercial/Industrial apprentice | −0.28 | −0.21 | −0.261 | −0.21 |
| Constant | −0.797*** | −0.07 | −0.790*** | −0.07 |
| Threshold specific constant 1 | −1.155*** | −0.12 | −1.530*** | −0.12 |
| Threshold specific constant 2 | −0.08 | −0.12 | −0.454*** | −0.12 |
| Number of observations | 188,081 | | 188,081 | |
| Log pseudolikelihood | −11,203,559 | | −11,191,672 | |
| Degrees of freedom | 34 | | 44 | |
| AIC | 22,407,208 | | 22,383,455 | |
| BIC | 22,407,664 | | 22,384,013 | |

Note:
*** Significant at the p = 0.001 level.
** Significant at the p = 0.01 level.
* Significant at the p = 0.05 level. NC: Not considered.

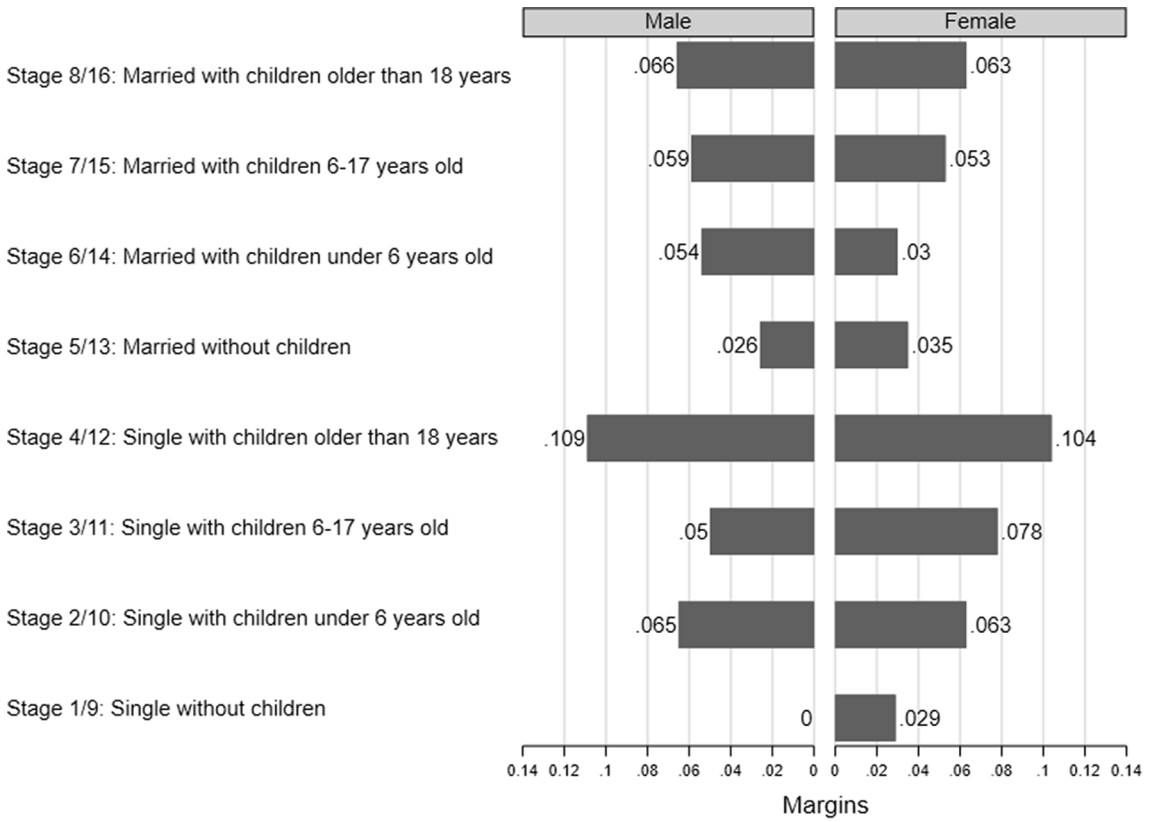


**Fig. 2.** Average marginal effects of family-life stage on "No telework" by gender. Note: Stages 1–8 for males, stages 9–16 for females. Stage 4 and 12 show biggest marginal effects on "No telework" behavior, which means individuals in these stages are least likely to telework. Source: Plot based on the results of average marginal effects (see supplementary material Table 3).

2010) tend to separate their work and family life domains (i.e., less telework participation) to prevent the negative spillover between multiple roles. This finding supports the segmentation theory (Frone, 2003). Regarding married females with children aged 0–5 years (stage 14), our finding is also partially consistent with the findings by Drucker and Khattak (2000) that parents with 0–5 years old children are more likely to telework than parents without children. One possible explanation is that when the household has small children, household and job obligations impose more spatial and temporal fixity constraints on women and telework may weaken the time–space constraints (Schwanen et al., 2008). This is consistent with our hypothesis that women in stage 14 are bearing an unequal share of household obligations and they are experiencing the more pronounced work-to-family conflict. The analysis shows that female parents during intense childcaring demand stages trade off career demands for their family responsibilities more often, tend to endure high family-to-work conflict over high work-to-family conflict by more telework participation.

**Pattern two** shows that, for individuals without children, single individuals (stages 1, 9) are more likely to telework than the married ones (stages 5, 13), in contrast, the partnered parents (stages 6, 8, 14–16) are more likely to telework than the single parents (stages 2, 4, 10–12). Regarding the pattern for individuals without children, this is supported by Drucker and Khattak (2000) that single individuals without children were more likely to telework than married individuals without children. As the individuals without children experience only slight work-to-family conflict and family-to-work conflict (Bennett et al., 2017; Erickson et al., 2010), the explanation power of role conflict theory might be low for those stages. It might be that telework seems to create more family-to-work conflict for married individuals than for single ones (more interruption from home instead of the office for married individuals compared to single individuals). In addition, this might also be explained by the social exchange theory which expresses that telework could be taken as a privilege for married couples that comes along with the cost of additional housework (for example, cleaning the house, doing the laundry). To avoid the unequal housework division, they might be less likely to work at home. Regarding single and partnered parents, the finding is consistent with the result of Jin and Wu (2011) who found that households with one adult and children are less likely to telework than households with multiple adults and children. Previous studies indicated that single parents experience more family-to-work conflict (as they do not have partners to share the childcare and other household chores), but not more work-to-family conflict than partnered parents (Reimann, 2019). Furthermore, telework is not helpful to reduce family-to-work conflict, and it might increase single parents' work-to-family conflict (Reimann, 2019). Hence, single parents are less likely to telework.

**Pattern three** shows that, for individuals without children, males (stages 1, 5) are more likely to telework than the females (stages 9, 13), on the other hand, for individuals with children, the females (stages 10, 12, 14–16) are more likely to telework than the males (stages 2, 4, 6–8). This is consistent with the research of Popuri and Bhat (2003), in which females were less likely to telework than males in the household without children, while more likely to telework than males in the household with children. This indicates that children might be the most important feature that influences individuals' telework behavior, analogous to that it is the primary factor in the family-life stage (Bennett et al., 2017; Erickson et al., 2010). Having children could not only increase both work-to-family conflict and family-to-work conflict as indicated in pattern one, but also trigger new bargaining and division of housework within couples, along with gender inequalities (Grunow et al., 2012; Scheiner, 2014). Childbirth tends to increase the gender division of household chores as females tend to increase their share of housework while males tend to decrease their share (Scheiner, 2014). In line with prevailing social expectations, particularly for females, they tend to become less tolerant of work-to-family conflict. Therefore, females with children are more likely to telework than males with children in order to manage work interference with family.

However, it should be mentioned that the gender-specific family-life stage and the work-life conflict perspective does not provide explanations for all population groups. This is particularly obvious for stages that are barely studied even from the work-life balance research area as discussed in the Literature review section, such as single men with 6–17 years old children (stage3).

#### *4.2.2. Individual demographics*

In both model estimates, age shows a positive effect towards telework, that is, individuals aged more than 35 years old incline to engage more in teleworking than those aged between 18 and 34, which is consistent with previous findings (Caulfield, 2015; Peters et al., 2004; Popuri and Bhat, 2003; Sener and Bhat, 2011; Walls et al., 2007). A possible explanation is that senior employees usually have more experience in working independently (Drucker and Khattak, 2000; Popuri and Bhat, 2003; Sener and Bhat, 2011). Additionally, younger employees may tend to have higher self-esteem in being around others at the workplace (Sener and Bhat, 2011). However, according to the results shown in Section 4.2.5, the first explanation does not hold in this estimation as seniority is negatively associated with telework.[8] A further conjecture would be that there might be generational differences regarding how individuals value their work and life, which has been confirmed in Anglo countries[9] (Bennett et al., 2017), and therefore influence their telework behavior. This might be also related to the fact that both work-to-family conflict and family-to-work conflict decrease by aging (Allen and Finkelstein, 2014), but the ebb and flow of individuals' work/family centrality and how it influences telework as individuals grow old is still underexplored.

The lower educational levels reduce the possibility of telework, which is consistent with previous findings (Drucker and Khattak, 2000; Popuri and Bhat, 2003; Sener and Bhat, 2011; Walls et al., 2007). It is probably because individuals with higher education levels have an advantage when bargaining with their employers to obtain the option to telework.

[8] The potential collinearity between age and seniority are also considered and examined in supplementary material Table 4, by constructing model Test 1 without age variable and model Test 2 without seniority variable. The test models indicate the current results are robust.

[9] The Anglo countries Bennett et al. (2017) examined: USA, Canada, UK, Australia.

#### 4.2.3. Household demographics

The lower the household income, the less likely the individual is to telework. This is consistent with many previous studies, explaining by the fact that individuals with higher income usually work within a more telework-friendly environment, and therefore, are more flexible regarding their working arrangement (Drucker and Khattak, 2000; Popuri and Bhat, 2003; Sener and Bhat, 2011; Singh et al., 2013). Compared with tenants, homeowners are more likely to telework, which may be confounded with higher ownership rates of high-income households. Paleti (2016) found the opposite effects that homeowners were less likely to telework than tenants.

Individuals in households with a higher employment rate (ratio of household workers to household size) are less likely to telework. One possible explanation is that they might be under less work pressure, and thus, also experience less work-to-family conflict that needs to be resolved by telework. In addition, we investigated the associations between telework and household size, number of household workers (see supplementary material Table 5), and found that both household size and number of household workers are negatively associated with telework. This is consistent with Singh et al. (2013) and Asgari et al. (2014). However, this is contrary to Sener and Bhat (2011), who found that the number of household workers is positively associated with telework choice and frequency. The relationships between household size/workers with telework are worthy to explore as they might not only influence the WFC/FWC, but also moderate the impact of telework on WFC/FWC (Golden et al., 2006).

#### 4.2.4. Environmental characteristics

Compared with former West Germany, the individuals working in former East Germany are less likely to telework, which confirmed our hypothesis 3. This is probably because of the different work-life modality by gender between former East and West Germany as we argued in Section 2.5.2. Specifically, with regard to the time use by gender, the former East German females work longer than their Western counterparts, while former West German women spend 27% more time on domestic work (41.9 h in former West Germany compared with 33.1 h per week in the East) (Bauer et al., 2007).

Regarding work-home locations and municipality size, individuals who work and live in the same state are less likely to telework. Individuals living in large-sized municipalities are more likely to telework. This is probably because when people live in large-sized municipalities this may result in longer commuting distance than those living smaller cities (Aguilera et al., 2016). Telework among those individuals may save commuting time so that they may be more efficient and productive (Ory and Mokhtarian, 2006; Sener and Bhat, 2011). Another reason is that large municipalities concentrate highly skilled professionals that are suited for teleworking (Aguilera et al., 2016; Vilhelmson and Thulin, 2016).

#### 4.2.5. Job characteristics

Seniority is negatively associated with telework for both model 1 and model 2. This is consistent with Walls et al. (2007), who found that tenure (i.e., years of work with the current employer) is negatively associated with telework. An explanation could be that workers with supervisory functions (which is correlated with seniority) are more likely to be at the workplace. However, this contradicts the findings of Popuri and Bhat (2003), who found that the length of service[10] was positively associated with telework.

Working hours is positively associated with telework in both models. This is partly consistent with research by Asgari et al. (2014) where total weekly working hours was positively associated with telework choice but negatively associated with telework frequency. As part-time/full-time work is directly defined by working hours, we did not include it in the analysis. However, it would be careless to assume that individuals with full-time work would be more likely to telework, as previous results found a positive association between part-time work and telework and also telework frequency (Drucker and Khattak, 2000; Paleti, 2016; Popuri and Bhat, 2003). The association of working hours and telework may be different for part-time and full-time employees. A part-time job tends to be more flexible with fewer working hours, which is conducive to telework (Felstead and Henseke, 2017). On the other hand, in line with the social exchange theory, teleworkers who work full time might increase their working hours, either to make use of the saved commuting time or as a reciprocation to the opportunity of telework (Abendroth and Reimann, 2018).

Individuals working in agriculture, forestry and fisheries are most likely to work at home. As 48.9% of them are self-employed, they probably just work where they live, for example, at their own farms. Individuals working in the service industry are more likely to telework than their counterparts (i.e., working in the manufacturing industry or trade, transport and communications industry). This is consistent with previous findings (Asgari et al., 2014; Sener and Bhat, 2011; Singh et al., 2013; Walls et al., 2007).

The association between firm size and telework is as expected, employees in smaller firms (less than 50 employees) are more likely to telework. This finding is also consistent with the findings of Walls et al. (2007). Specifically, for firm sizes smaller than 10 employees, the positive effect on telework is noteworthy. It is possible that smaller companies may have a more flexible working schedule.

Individuals who work constantly or regularly on Saturdays are less likely to telework, while individuals who work constantly or regularly on Sundays are more likely to telework.[11] This may reflect that some individuals who work on Sundays have to work at home as their official workplace is closed. Individuals who work constantly or regularly in the evening hours are more likely to telework, which may reflect the fact that some individuals just prefer to work late hours. While individuals who work constantly or regularly at night are less likely to telework, which also makes sense as those individuals are more likely to work in special occupations that need

[10] Also interpreted by the authors as the working time with the current employer, so it is the same as the definition of "seniority" in this paper and "tenure" in Walls et al. (2007)'s research.

[11] The potential collinearity between Saturday work and Sunday work is also considered and examined in supplementary material Table 4, by constructing model Test 3 without Saturday work and model Test 4 without Sunday work. The test models confirm the current results.

night shift hours, such as utility providers or hospitals that need to operate 24/7.[12]

## 5. Conclusions

While work-life balance perspectives are commonly studied in the telework literature, this study proposed a work-life conflict perspective to understand telework behavior with a specific focus on the impact of the family-life stage by gender. Our findings suggest that the family-life stage associates with telework in a complex way. Three patterns have been identified. Specifically, irrespective of gender and marital status, parents are less likely to telework than their counterparts without children (pattern one). Among employees without children, single individuals are more likely to telework than the married ones, and males are more likely to telework than females (pattern two). On the contrary, for individuals with children, the partnered parents are more likely to telework than single parents, and females are more likely to telework than males (pattern three). Our results indicate that children are the most important feature in family-life stages for an individual's telework behavior.

This study cannot explore the motivation for telework, but merely the outcome observable in census data. It is possible that the desire to telework is similar for men and women, but that other forces (not visible in the census data) lead to different tendencies to telework by gender. This could include, among others, social pressure for women to be at home for children and to take care of the household (Grunow et al., 2012). This may also be a result of the income gap between men and women, which may motivate couples to allow the man to pursue his career to the maximum extent at the workplace, while the woman might tend to telework and take care of tasks at home (this is referred as the "economic dependency" theory, other comparative theories about the gender inequality in housework division can be found in Apps and Rees (2005), Grunow et al. (2006), Grunow et al. (2012), and Gupta (2006, 2007)). Nevertheless, these underlying motivations to decide in favor of or against telework are not part of this study. Our study mainly focuses on exploring the outcome of telework by gender and life stage, as it can be seen in census data.

### 5.1. Strengths and limitations

There are several limitations to this study. Firstly, information about the option of telework is not available in this study. It is perceivable, for example, that women are offered to telework less often than men (Singh et al., 2013). In some cases, telework is seen as limited career options within a firm. Although the zero-inflated model is applied to control the large number of individuals without telework options, further empirical study of individuals who have the option to telework is necessary. Secondly, the definition of the dependent variable cannot distinguish those who live and work at the same place all the time (homeworker) from those who can choose to work from home some days (teleworker). They might have different work-life balance/conflict experiences. However, by controlling for type of industry and occupation (e.g., agriculture), we attempted to take this into consideration to some extent. Finally, this study only considers telework in Germany. Whether the patterns observed in this study can be transferred to other countries cannot be concluded. Different patterns are more likely to be identified for countries where the social norms regarding work and family life are distinct from Germany.

Some strengths of this study should also be pointed out. First, this study takes advantage of two research branches, namely the influence of work-life balance/conflict on telework and the influence of telework on work-life balance/conflict. The former is more popular in the transportation literature, while the latter got extensive attention in work-life interrelationship, applied psychology, occupational health and gender equality literature. The integration of empirical evidence provides a solid foundation for this study. Second, this is the first study to investigate the individual's telework behavior from the work-life conflict perspective, which complements the traditional framework that mostly focused on job characteristics or location-dependent factors. Compared with the work-life balance perspective, it provides an abundant theoretical foundation to achieve a more unified and plausible basis for the previously fragmentary understanding regarding the relationships between telework and gendered family-life stage.

### 5.2. Practical implication

This study provides implications for the telework practice in three aspects, namely government, employer and employee. First, as childcare is a primary source of family-to-work conflict that hinders telework, the government needs to provide sufficient support in formal childcare resources. For example, more funding could be provided for early childhood education and care (ECEC), such as increase the child-staff ratios, improve the staff's professional level and working conditions, ensure quality regulations for both public and private childcare services, provide universal and equitable access for all children, etc. (OECD, 2017a, 2017b). Also, one key driver of the ECEC policies is to improve the female labor force participation, especially for those with high childcare responsibility (OECD, 2006, 2017a). This group of parents shows a high likelihood to telework according to this study.

Second, companies could provide more telework options to their employees who are in high work-life conflict stages (e.g., individuals with 0–5 years old children). This could reduce concerns about their family responsibilities while at work. For employees who work at home, employers should avoid electronic monitoring and stiff time schedules, which might exacerbate rather than mitigate employees' work-to-family conflict (Gajendran and Harrison, 2007; Michel et al., 2011). Moreover, companies should respect

[12] Note that no causal relationship (that the timing of working might be the reason for telework) is implied here. As a matter of fact, it is possible that the distinct pattern of timing of working of teleworkers might be the consequence of telework, as the previous empirical study by Alexander et al. (2010) has indicated.

the employees' right to be disconnected to avoid that a ceaseless work demand infiltrates family life (Eurofound and the International Labour Office, 2017).

From the employee's perspective, there are also some skills to alleviate the family-to-work conflict and improve their work-at-home experience. This includes, for instance, sufficient communication with family members to achieve consensus about the teleworker's work and family boundary when they work at home, in addition to a corresponding dwelling layout as implicated by the boundary theory (Ashforth et al., 2000; Clark, 2000; Holloway, 2007).

Furthermore, the forced telework due to the COVID-19 pandemic in 2019/2020 may encourage more telework in the future. Governments have learned that telework is an important factor to manage a crisis, employers have experienced first-hand that some telework might be very productive, and employees might have started to enjoy the benefit of eliminating the commute and spending more time with their family. Whether this experience will have a long-term effect on telework is yet to be seen.

### 5.3. Future research recommendation

Further research is necessary for several areas. First, more attention should be paid to the dynamic characteristics of telework behavior through longitudinal studies. As implicated in this study, telework behavior could change not only due to change of job, but also due to family-life stage development and the experienced work-life conflict. Without considering these dynamic changes at the individual level, the long-term impact of telework on transportation would be inaccurate.

Second, although multiple theories are applied in Section 2.5.1 to construct the work-life conflict perspective, this study mainly focuses on the role conflict theory, especially the bidirectional WFC and FWC. Other role conflict dimensions are worthy to be added in the trade-off strategy framework, such as the time-based, strain-based, and behavior-based conflict. Furthermore, more theoretical perspectives should be explored, e.g., the positive spillover between work and family domains, which is also bidirectional including work-to-family enrichment and family-to-work enrichment (Greenhaus and Powell, 2006). In addition, theories pertaining to the interrelationships between employee and workplace (employer/organization/work outcome) might be worthful in understanding the associations between personality, job-related variables and telework behavior, e.g., the social exchange theory (Caillier, 2011), social identity theory (Allen David et al., 2003), social isolation theory (Feldman and Gainey, 1997), media richness theory (Daft and Lengel, 1986), and social presence theory (Gajendran and Harrison, 2007; Short et al., 1976).

Another research point that might benefit from theoretical perspectives is the telework frequency, which "represents a continuum of psychological commitment to the telework arrangement" (Gajendran and Harrison, 2007). A psychological threshold (i.e., 50% of working time) exists to distinguish teleworkers into two classifications, the office-centered teleworker (i.e., low-frequency teleworker) and the home-centered teleworker (i.e., high-frequency teleworker), which have different motivations for telework participation (Konradt et al., 2003). The psychological commitment continuum and threshold perspective would be important for future research on telework frequency.

Lastly, culture also matters. For example, in Confucian countries (such as China) or Mediterranean countries (for example, Spain, Italy and Greece), informal childcare (for example, delegating the childcare to grandparents or other family members) provides huge support (Chen, 2014; García-Mainar et al., 2011). According to Chen (2014), over 45% of households with preschool children (aged 0–6) had maternal or paternal grandparents co-residing in the same household. The co-residence pattern not only influences the housework division, but also generates a new inter-role conflict (e.g., between mother-in-law and daughter-in-law (Zhu, 2007)). This may imply a different telework decision for Chinese and Mediterranean parents from parents in Northern Europe or North America. Furthermore, it might be worthy to consider the unrelated society phenomenon in the research of telework in Japan[13] (NHK, 2015). For employees who have lost their geographic connection and close family ties, they might be less likely to telework as it might cause unpleasant social isolation.

Human relationship is an active research area, which could be beneficial for the study of telework behavior. And vice versa, the research of this new work/life modality could also provide material and adjustment for those human-relationship theories (Chernyak-Hai and Rabenu, 2018).

## CRediT authorship contribution statement

**Shihang Zhang:** Conceptualization, Methodology, Software, Validation, Formal analysis, Investigation, Data curation, Writing - original draft, Writing - review & editing, Visualization, Funding acquisition. **Rolf Moeckel:** Resources, Supervision, Writing - original draft, Writing - review & editing, Funding acquisition. **Ana Tsui Moreno:** Software, Data curation, Writing - original draft. **Bin Shuai:** Resources, Supervision. **Jie Gao:** Methodology, Writing - original draft, Writing - review & editing.

## Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

[13] The unrelated society describes individuals with no geographic connection, no consanguinity, and no social connection, i.e., extreme social isolation (NHK, 2015).

## Acknowledgments

This research was supported by the Technische Universität München – Institute for Advanced Study, funded by the German Excellence Initiative and the European Union Seventh Framework Programme (No. 291763), and China Scholarship Council (CSC) (No. 201607000107).

## Appendix A. Supplementary material

Supplementary data to this article can be found online at https://doi.org/10.1016/j.tra.2020.09.007.

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