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# THE stress cost of children on moms and dads☆

Hielke Buddelmeyer [a], Daniel S. Hamermesh [b,*], Mark Wooden [a]

[a] *Melbourne Institute of Applied Economic and Social Research, (Level 5, FBE Building, 111 Barry St), University of Melbourne, Victoria 3010, Australia*
[b] *Department of Economics, Royal Holloway University of London, Egham Surrey TW20 0EX, United Kingdom*

## ARTICLE INFO

## ABSTRACT

We use longitudinal data describing couples in Australia from 2001 to 12 and Germany from 2002 to 12 to examine how demographic events affect mothers' and fathers' perceived time and financial stress. Consistent with the view of measures of stress as proxies for Lagrangean multipliers in models of household production, we show that births increase time stress, especially among mothers, and that the effects last at least several years. Births also slightly raise both parents' financial stress. While the departure of a child from the home reduces parents' time stress, its negative impacts on the tightness of the time constraints are much smaller than the positive impacts of a birth.

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## 1. Background

We ask whether the addition of a child to a family imposes costs that are not accounted for in the immense literatures on the monetary cost of children and on equivalence scales, and thus whether there are hitherto unaccounted factors that affect the decision to have a child or that increase the perceived costs of rearing a child. The literature on equivalence scales focuses solely on the monetary costs of children (e.g., Muellbauer, 1977; Pollak and Wales, 1979; Bourguignon, 1999). The sparser literature on the time costs of children (e.g., Gustafsson and Kjulin, 1994; Bradbury, 2008) engages in accounting exercises, totalling up the amounts of time that each parent devotes to child care, and perhaps valuing them, and examining gender differences and secular changes in time allocated to child care.

Hamermesh and Lee (2007) constructed and estimated a model describing cross-section differences in the extent of expressed time stress. The theoretical basis was Becker's (1965) model of the use of time and goods to produce commodities that contribute to a household's utility. The theoretical part of the study identified time stress as the Lagrangean multiplier on a household's time constraint and linked financial worries to the Lagrangean multiplier on its goods constraint. Using cross-section data from Australia, Germany, Korea and the U.S., they found that individuals with higher Beckerian full incomes expressed greater feelings of time stress, consistent with a more tightly binding time constraint, that they were less likely to express concerns about money (consistent with a looser goods constraint), and that women expressed more time stress than men.[1]

Our approach here combines these two strands of the literature. We examine the extent to which people find that the time and goods constraints in their utility maximization bind more tightly when a child is added to the household and

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☆ Insanity is hereditary. You can get it from your children. [Levenson, 1981]

* Corresponding author.

*E-mail address:* hamermes@austin.utexas.edu (D.S. Hamermesh).

[1] DeVoe and Pfeffer (2011) use several waves of the Australian data set to demonstrate the relationship between income and time stress.

how these effects differ between mothers and fathers. We are not examining generalized responses to a birth, such as happiness or life satisfaction (for the mixed results on these see, for example, Stanca, 2012, Pedersen and Schmidt, 2014, and Baetschmann et al., 2016), nor are we examining emotional responses to particular aspects of child-rearing (e.g., Connelly and Kimmel, 2015). Instead, we study how a specific life event—the birth of a child—affects the empirical analogues of parameters that arise within a family's welfare maximization. We thus develop a new dimension of the cost of children. We also complement the examination of the impact of births on the household's utility maximization by studying the impact on mothers and fathers of what might be viewed as the obverse of a birth—the departure of a child from the household.

To obtain these estimates we need data sets that contain respondents' views of the time and monetary stress that they perceive, our analogues to the Lagrangean multipliers in their utility maximization. We also require longitudinal data, since in order to identify the effect of an addition to the household we need a household-specific baseline against which to compare the empirical counterparts to the multipliers. Fortunately, since 2001 the Household, Income and Labor Dynamics in Australia (HILDA) Survey has collected annual information from a panel of respondents on their perceptions of time and financial stress. Also, since 2002 the German Socio-Economic Panel (SOEP) has collected similar information biennially. We use both data sets in the empirical work here. While there are obvious linguistic and cultural differences between the two countries, using data sets from both allows us to check that results do not stem only from single-country idiosyncrasies.

## 2. Theoretical motivation and considerations

Consider a household that combines goods (a vector $x_j$) and the time of each spouse (vectors $T_j^m$ and $T_j^f$), where m is male and f female, to produce a vector of commodities $Z_j$ (j=1, ..., N) that determines its current utility:

$$U = U\left(Z_1\left(x_1, T_1^m T_1^f\right), \ldots, Z_N\left(x_N, T_N^m T_N^f\right)\right). \tag{1}$$

The maximization of this utility function, given the technologies of household production and the spouses' wage rates, $W^m$ and $W^f$, unearned income I, and the vector of goods prices that it faces, $P_j$, yields a utility-maximizing vector of demands for both time and goods inputs into the production of each commodity.[2] Although it may seem crass, one of those commodities, and the one we are most interested in is children, K, the services of whom are produced by a combination of parents' time and purchases of goods.

The demands for time and goods inputs are functions of these prices. Similarly, the household's Lagrangean multipliers on the spouses' time, $\lambda^m$ and $\lambda^f$, and on goods, $\mu$, are functions of the parameters facing the household — the wage rates, unearned income and prices for goods. We can thus write each as:

$$\lambda_t^m = \lambda^m\left(W_t^m, W_t^f, I_t, P_{jt}\right); \tag{2a}$$

$$\lambda_t^f = \lambda^F\left(W_t^m, W_t^f, I_t, P_{jt}\right); \tag{2b}$$

$$\mu_t = \mu\left(W_t^m, W_t^f, I_t, P_{jt}\right), \tag{2c}$$

where t is some time period. Comparing across households, we make the standard assumption that all households face the same prices for goods, so that these can be ignored here and in the empirical work. The usefulness of the model comes from its prediction that higher W and I raise $\lambda^m$ and $\lambda^f$ and lower $\mu$, given that spouses in every couple face the same twenty-four per day time constraint.

We could estimate Eq. (2) directly from survey respondents' answers on their perceived time and financial pressures. Some individuals may, however, always feel pressured, and others may feel less pressured, even in the face of the same objective circumstances. A new child increases the time and goods inputs that need to be devoted to the commodity, children, and thus tightens both the goods and the time constraints facing the family. Also, the amount of pressure generated by the birth may depend on its interaction with the family's existing demographic structure. Taking these considerations together, recognizing that all the information affecting maximization in the previous period will be subsumed by the outcomes in that period, and linearizing (2), we can rewrite the model as:

$$\lambda_t^m = a_1\lambda_{t-1}^m + a_2\lambda_{t-1}^f + a_3\mu_{t-1} + \alpha_1\Delta K_t + \alpha_2 X_t + v_t^m, \tag{3a}$$

$$\lambda_t^f = b_1\lambda_{t-1}^m + b_2\lambda_{t-1}^f + b_3\mu_{t-1} + \beta_1\Delta K_t + \beta_2 X_t + v_t^F, \tag{3b}$$

$$\mu_t = c_1\lambda_{t-1}^m + c_2\lambda_{t-1}^f + c_3\mu_{t-1} + \gamma_1\Delta K_t + \gamma_2 X_t + \eta_t, \tag{3c}$$

where: a, b and c are parameters describing the autoregressions; X is a vector that includes both the wage rates and unearned income included in (2) plus personal/family characteristics that induce heterogeneity that we wish to control for; $\eta$

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[2] Eq. (1) describes current-period utility, but clearly a planned birth must, if parents are rational, raise lifetime utility. Thus a complete model would append a term like $e^{-rT}U(.)$, indicating the present value of the infinite stream of satisfaction from creating a dynasty. This extension rationalizes the possible increase in happiness engendered by children with the possible tightening of the time and goods constraints on which we focus. The utility function implies pooling of resources in household production. More complex assumptions would not yield any additional readily testable implications about time or financial stress in the context of the data available to us.

and $\nu$ are normally distributed error terms; and $\Delta K$, the focus of this study, denotes the change in the family's demographic structure, including crucially the addition of a child into (or later in life, departure from) the household.

To link this model to the available data we proxy $\lambda$ by S, time stress as perceived by respondents in our samples, and proxy $\mu$ by F, financial stress as perceived. We thus follow the link between theory and data used by Hamermesh and Lee (2007). Here the crucial empirical question is how large absolutely and relatively are each of $\alpha_1$, $\beta_1$ and $\gamma_1$, the responsiveness of each spouse's time or financial stress to a birth.

A potentially important issue here is the endogeneity of births in a year in response to stress (both time and financial) in that same year. To model this potential endogeneity in this context, let us assume that, along with many other things described by the vector of variables X, both expected time stress and expected financial stress affect the probability of having a child. Let S* be the upper limit to perceived time stress (S) beyond which people will decide not to have a child, and let F* be the analogous upper limit to perceived financial stress (F). Then assuming that the couple has complete control over its fertility, the probability of a birth is the joint probability:

$$\Pr\{\Delta K_{i,t+1} = 1\} = \Pr\{[\alpha E(\Delta X_{i,t+1}) + \beta S_{it} + \varepsilon_{it} < S*], [\gamma E(\Delta X_{i,t+1}) + \delta F_{it} + \theta_{it} < F*]\}, \tag{4}$$

where $\varepsilon$ and $\theta$ are normally distributed and presumably not independent, and $\alpha$, $\beta$, $\gamma$ and $\delta$ are parameters describing this probability for couple i. Eq. (4) can be rewritten as the bivariate probit:[3]

$$\Pr\{\Delta K_{i,t+1} = 1\} = \Pr\{[\varepsilon_{it} < S* - \alpha E(\Delta X_{i,t+1}) - \beta S_{it}], [\theta_{it} < F* - \gamma E(\Delta X'_{i,t+1}) - \delta F_{it}]\}. \tag{5}$$

There are several ways of dealing with this potential endogeneity. We could estimate (3a)–(3c) jointly with the selection Eq. (5). The difficulty with this approach lies in finding exclusion restrictions appropriate for the four equations (the couple's financial stress, the time stress of each spouse, and fertility). An alternative approach would argue that any biases to the estimates of the impact of a birth on time and financial stress that are caused by the potential endogeneity of births will be negative. Those parents who expect smaller increases in stress are those who are more likely to have a child. Thus we would expect that any estimated positive impacts of a birth on stress will understate the "treatment effect" that would be observed if births were distributed randomly across the population of couples arrayed by the impact of births and changing stress. As estimates of the average treatment effect of a birth on the treated (new parent), our estimates will thus be biased toward zero.

## 3. Data and descriptive statistics

We use data from longitudinal household surveys in Australia and Germany, the only two countries with such surveys that include information on time and financial pressures in repeated waves. The countries are obviously different linguistically and culturally. Yet they are remarkably similar in terms of the actuality and views of women's roles in the labor market. Thus in 2014 female labor-force participation rates were 71.2 and 72.9 in Australia and Germany respectively, and 38% of female workers in both countries were working part-time (OECD, 2015). Also, attitudes toward women's role in labor markets are fairly similar, with responses to a question in the World Value Surveys about who should obtain jobs during recessions showing much more liberal attitudes in both countries than is true worldwide (authors' calculations).[4]

Both surveys that we use provide nationally representative longitudinal data sets describing the populations of the countries studied. The HILDA Survey asks the following question: "How often do you feel rushed or pressed for time?" Five alternative response options are provided: "almost always", "often", "sometimes", "rarely" and "never". Thus we can index t=2001, 2002, ..., 2012, which, allowing for lagged values, enables us to estimate autoregressions based explicitly on (3a) and (3b) for eleven years of births. Participants are also asked to rate their satisfaction with their financial situation on an eleven-point 0–10) scale ranging from "totally dissatisfied" to "totally satisfied", allowing us to estimate autoregressions based explicitly on (3b). To provide comparability with the scale on time stress, we collapse the responses to this latter question into five categories.[5] Thus the autoregressions that we estimate track the Lagrangean multipliers $\lambda$ and $\mu$. Since each spouse expresses satisfaction with the household's financial situation, we estimate separate equations for each spouse and test for the equality of their responses to a birth. Couples are included until separation or a spouse's death, and a person who "re-couples" is reintroduced into the sample if observed in two consecutive years with the new partner.

We have six waves of data from the SOEP with the necessary information, t=2002, 2004, ..., 2012, allowing, with the required lag, for five biennia of births. Biennially the SOEP has included the question: "Think about the last four weeks. How often during this period did it happen that you felt rushed or under time pressure?" Possible responses are "always", "often", "sometimes", "almost never" and "never". This question was included initially in the SOEP at the suggestion of one of the

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[3] Since having children is hardly an uncommon event, one might wonder why couples do not forecast its impact on their time and financial stress—essentially, why they might lack rational expectations about the effects of a birth on stress. Odermatt and Stutzer (2015) provide some evidence and arguments for why people do not forecast very well the impact of life events on a loosely related concept, their happiness.

[4] The question in the Surveys asks if the respondent agrees with the statement, "When jobs are scarce, men should have more right to a job than women."

[5] To make the responses on financial stress commensurable with those on time stress we recode responses 0–2 as 5 (4.9% of the sample), 3–4 as 4 (9.3%), 5–6 as 3 (28.2%), 7–8 as 2 (45.2%), and 9–10 as 1 (12.4%). Here and throughout this study we weight all sample observations by their sampling weights. Ordered probit and least-squares regressions on the original 11-point scale of responses yield results on the crucial variables that are qualitatively identical to those reported in the text and tables.

authors of this article with the express intent of matching the HILDA Survey question as closely as possible. Nonetheless, there are important differences between the Surveys. Notably, the SOEP uses a four-week reference period and employs a multi-mode approach, with data collected both by interviewer and via self-administration. In contrast, in the HILDA Survey this question is always administered as part of a separate self-completion questionnaire. Perhaps because of these differences the distribution of responses to this question in the SOEP data are tilted more heavily toward being less rushed for time than in the HILDA Survey data.[6] The SOEP also asks all respondents the same question about financial stress as the HILDA Survey, and we treat responses exactly the same.[7] Thus, except for relying on biennial observations, the estimates of the determinants of the analogues of λ and μ are based on similar questions in the two data sets.[8]

Table 1 presents statistics describing the couples included in the sub-samples from the HILDA Survey and SOEP over which we estimate (3a)–(3c). Here and in all subsequent tables involving the examination of the impacts of births we exclude couples in which the wife is over age 45. In the HILDA Survey sub-sample wives report being significantly more stressed for time than their husbands (paralleling the greater time stress perceived by women generally that was reported in Hamermesh and Lee, 2007), but both spouses feel roughly the same financial stress. Ten percent of the couples produced a child between successive interviews (and thus between responses on time and financial stress), and the majority had other children present too. Half the respondents reported being in excellent or very good health, with a higher fraction of wives reporting this. During the average week husbands spent 46 h working (in paid employment) and commuting, while their wives spent nearly 24 h per week in these market-related activities. Time spent in household production was almost reversed, so that reported (not from time diaries) total market and non-market work time was not quite identical for the spouses (see Burda et al., 2013).[9] Average total annual earnings (in 2012 dollars) of couples were around A\$96,000, while average unearned income (in 2012 dollars) among these couples was about A\$20,000.[10]

The descriptive statistics from the SOEP show similar patterns on time stress. Wives are significantly more stressed for time than their husbands. Husbands, however, express significantly more financial stress than their wives. About one-eighth of the couples experience a birth during a biennium over the time period 2002-12 (implying, consistent with data on vital statistics, a lower birth rate than in Australia). In line with popular perception, husbands report more market work time than their wives, and wives report significantly more home production time on weekdays. Average annual earnings of the couples are roughly €53,000 per year (in 2012 prices), which is consistent with published data, but average unearned income, at about €7100 per year, may be low (although these are prime-age intact couples).[11]

## 4. Preliminary examination of patterns of stress

As a first step toward the estimation of (3a)–(3c), and to obtain a picture of how a birth/adoption alters the time and goods constraints, we examine transitions of the empirical counterparts of λ and μ. Consider columns (1) and (3) of the top panel of Table 2, which show the fractions of the samples for which time stress increased, remained the same or decreased between annual interviews in the HILDA Survey sub-sample, separately by gender and by the indicator for the addition of a child to the household. Husbands in households with a birth are more likely than other husbands to feel increasingly stressed for time. Comparing the changes in time stress for men yields a test statistic of $\chi^2(2)=15.99$ (p<0.001). Wives' time stress is increased even more significantly on average by a birth: the same test for Australian women in this table yields $\chi^2(2)=24.97$ (p<0.001).

Columns (2) and (4) in the upper panel of Table 2 show the same changes (over two-year periods) among couples in the SOEP. For fathers the trivariate distributions (more, the same, or less time stress) are not statistically distinguishable ($\chi^2(2)$ =3.96, p=0.14). Among wives, however, the patterns differ greatly, with a much greater fraction exhibiting increases in time stress if a birth has occurred in the biennium ($\chi^2(2)=8.17$, p=0.02, on the trivariate distributions).

In columns (1) and (3) of the bottom panel of Table 2 we present the analogous patterns of changes in perceived financial stress from the HILDA Survey, again separately for husbands and wives by the indicator for the addition of a child to the household. As with time stress, financial stress increases more among new mothers than new fathers. Comparing households without and with a birth, husbands in the latter group are more likely to perceive an increase in financial stress than those in the former group ($\chi^2(2)=25.55$, p<0.001), but the difference between the changes in financial stress among wives is larger and even more significant statistically ($\chi^2(2)=37.68$, p<0.001).

Columns (2) and (4) in the bottom panel of Table 2 present the same calculations for biennial transitions in financial stress from the SOEP. For both spouses there are more increases in financial stress among those couples that experience a

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**Table 1**
Descriptive statistics: couples (means and standard deviations).

| Variable[a] | HILDA (N=7376) | | SOEP (N=7525) | |
|---|---|---|---|---|
| | Husband | Wife | Husband | Wife |
| Time stress | 3.41 | 3.59 | 3.14 | 3.25 |
| | (0.85) | (0.87) | (0.97) | (0.95) |
| Financial stress | 2.45 | 2.43 | 2.67 | 2.56 |
| | (0.98) | (0.97) | (1.05) | (1.06) |
| Child born in year | 0.10 | | 0.12 | |
| / Born in last 2 years | (0.29) | | (0.33) | |
| Child 0–4 | 0.46 | | 0.17 | |
| | (0.68) | | (0.40) | |
| Child 5–10 | 0.53 | | 0.50 | |
| | (0.78) | | (0.68) | |
| Child 11–15 | 0.34 | | 0.37 | |
| | (0.66) | | (0.62) | |
| Child 16–18 | 0.13 | | 0.18 | |
| | (0.38) | | (0.43) | |
| Excellent or very good health | 0.51 | 0.57 | 0.59 | 0.61 |
| / very good or good health | (0.50) | (0.49) | (0.49) | (0.49) |
| Work and commute time | 46.23 | 23.78 | 40.43 | 20.05 |
| / Work time | (17.98) | (20.21) | (15.87) | (17.60) |
| Home production time per week | 25.22 | 50.10 | 3.73 | 9.65 |
| / Home production time per weekday | (18.72) | (34.24) | (3.10) | (7.10) |
| Earnings: (2012)A$ per week | 1269 | 584 | 794 | 294 |
| / Earnings: (2012) € per week | (1005) | (610) | (598) | (336) |
| Unearned income: (2012) A$ per week | 384 | | 147 | |
| / Unearned income: (2012) € per week | (1098) | | (276) | |

[a] The first variable label describes the HILDA measure, the second the SOEP measure.

**Table 2**
Year-to-year transition matrices on stress, with or without birth, HILDA 2001–12, SOEP 2002–12[a].

| No birth:<br>Birth: | HILDA<br>(N=11,203)<br>(N=1172) | SOEP<br>(N=6571)<br>(N=954) | HILDA<br>(N=11,228)<br>(N=1216) | SOEP<br>(N=6567)<br>(N=958) |
|---|---|---|---|---|
| | **Time Stress** | | | |
| **Change in Stress** | **Men, No Birth** | | **Women, No Birth** | |
| Increase | 22.2 | 29.1 | 22.2 | 28.7 |
| Same | 54.8 | 43.0 | 53.8 | 43.5 |
| Decrease | 23.0 | 27.9 | 24.0 | 27.8 |
| | **Men, Birth** | | **Women, Birth** | |
| Increase | 25.7 | 28.6 | 32.5 | 37.8 |
| Same | 55.6 | 46.0 | 49.5 | 38.2 |
| Decrease | 18.7 | 25.4 | 18.0 | 24.0 |
| | **Financial Stress** | | | |
| **Change in Stress** | **Men, No Birth** | | **Women, No Birth** | |
| Increase | 22.6 | 27.1 | 23.6 | 25.2 |
| Same | 53.2 | 49.3 | 50.0 | 48.3 |
| Decrease | 24.2 | 23.6 | 26.4 | 26.5 |
| | **Men, Birth** | | **Women, Birth** | |
| Increase | 28.3 | 27.9 | 31.0 | 34.3 |
| Same | 51.2 | 51.3 | 50.2 | 41.5 |
| Decrease | 20.5 | 20.8 | 18.8 | 24.2 |

[a] The numbers of observations differ slightly for men and women in each category because we condition on item non-response on the control variables used in subsequent regressions.
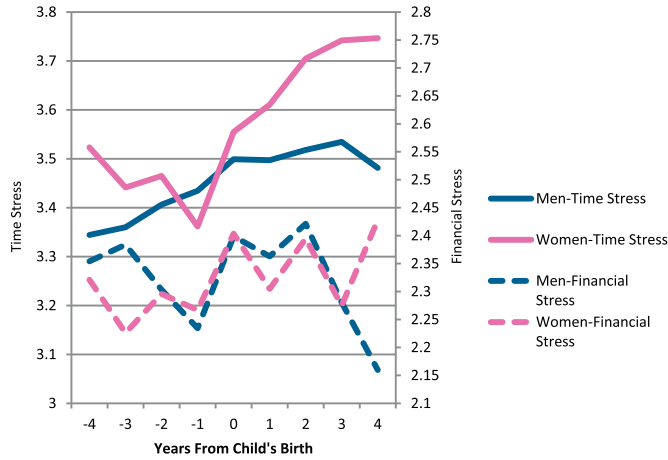
**Fig. 1.** Time and financial stress before and after birth of a child, HILDA 2001–12.
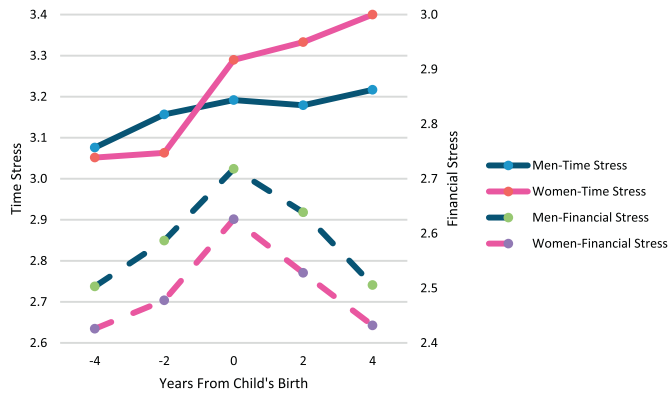


**Fig. 2.** Time and financial stress before and after birth of a child, SOEP 2002–12.

birth. Among men we cannot reject the hypothesis that the trivariate distributions are the same ($\chi^2(2)$=4.18, p=0.12). For their wives, however, the difference in the distributions is highly statistically significant ($\chi^2(2)$=11.18, p=0.004).

We can expand upon these one- or two-year transitions by examining averages of time and financial stress for each year before and after a birth, thus accounting for any changes in stress that might be missing from the models that include only one year of lags (but excluding the vector X, and not based on comparisons to couples without a birth in a particular year or biennium). Fig. 1 presents these measures for both spouses in couples that produced a child, from four years before the birth through four years after, in the HILDA Survey. In this and subsequent figures the paths of time stress are denoted by solid lines, and those of financial stress by dotted lines. The picture is of clear increases in both types of stress for both spouses after a birth; but paralleling the results for Australia in Table 2, the graph suggests that the increases in both types of stress are greater for the wife than for her husband, and that they are greater for time than for financial stress. Indeed, the wife's time stress continues to rise steadily each year after the birth, while her financial stress remains constant. The husband's time and financial stress both diminish, although they remain higher than they were on average before the birth. While the path of women's time stress in the figure cannot be explained by aging, men's could. But the estimates of (3) presented below, which include many covariates, including age, vitiate this potential difficulty.

The patterns in the figure suggest care in interpreting parameter estimates of (3a)–(3c). For women, but not men, there is an "Ashenfelter dip" in both time and financial stress in the year before the birth, especially so for time stress (Ashenfelter, 1978). Indeed, perhaps the temporary decrease in stress increases the couple's interest in having a child, as the discussion surrounding Eqs. (4) and (5) suggests. Regardless, these findings indicate that estimates of the determinants of current stress that include only one lagged value may overstate the impact of the birth for women in the Australian data. For men there is no pre-birth dip in time stress, but there is a pre-birth dip in financial stress.

In the SOEP, for which the patterns of time and financial stress before and after a birth are shown in Fig. 2, there is no evidence of dips in the biennium before a birth. There may in fact be no dips, but the inability to detect any could be due to the relative infrequency with which the data on time and financial stress are collected.

**Table 3**

LS estimates of the effects of a birth on stress, HILDA[a] (N=7376).

| Independent variable: | Time stress (5 to 1) | | Financial stress (5 to 1) | |
|---|---|---|---|---|
| | Husband | Wife | Husband | Wife |
| Lagged stress (own) | 0.547 | 0.507 | 0.498 | 0.466 |
| | (0.013) | (0.015) | (0.017) | (0.016) |
| Birth in past year | 0.093 | 0.254 | 0.063 | 0.072 |
| | (0.032) | (0.040) | (0.041) | (0.039) |
| Excellent or very good health | −0.087 | −0.113 | −0.152 | −0.152 |
| | (0.019) | (0.018) | (0.021) | (0.024) |
| Work and commute time/week (own) | 0.007 | 0.009 | −0.003 | −0.001 |
| | (0.001) | (0.001) | (0.001) | (0.001) |
| Home production/week (own) | 0.002 | 0.002 | 0.001 | −0.0003 |
| | (0.001) | (0.001) | (0.001) | (0.0004) |
| Earnings (own) | −0.006 | 0.022 | −0.118 | −0.172 |
| | (0.010) | (0.020) | (0.012) | (0.024) |
| Work and commute time/week (partner) | −0.0001 | −0.0001 | 0.0001 | −0.001 |
| | (0.001) | (0.0007) | (0.0008) | (0.0008) |
| Home production/week (partner) | −0.0001 | −0.0001 | −0.0002 | 0.0008 |
| | (0.0004) | (0.0007) | (0.0005) | (0.0006) |
| Earnings (partner) | 0.007 | 0.021 | −0.073 | −0.070 |
| | (0.020) | (0.011) | (0.024) | (0.013) |
| Unearned income/week | 0.008 | 0.024 | −0.047 | −0.048 |
| | (0.007) | (0.009) | (0.012) | (0.009) |
| $R^2$ | 0.383 | 0.374 | 0.430 | 0.393 |

[a] Also includes all three other lagged stress measures, a vector of measures of numbers and ages of children, year indicators and indicators of the respondent's and spouse's decadal ages (31–40 and 41+). Robust standard errors clustered on person identifiers are reported here and in subsequent tables reporting coefficient estimates.

## 5. Estimates of models of stress

Table 3 lists least-squares estimates of analogues to (3a)–(3c) using the HILDA Survey (with separate estimates of the impacts on financial stress for husbands and wives). We include and report on the impacts of each spouse's time allocation, weekly earnings (and thus, since work hours are included, implicitly the full prices of their time), the family's unearned income, and the respondent's self-reported health. (See the online Data Appendix for further details of these and the other variables included.[12]) For ease of interpretation, we present ordinary least squares estimates. We did, however, also estimate the models using ordered probit, with no resulting qualitative differences from the least-squares estimates. All four estimated impacts of a birth on stress are positive and statistically significant, and the average derivatives differed by less than 0.02 from the OLS estimates presented in Table 3.

More time spent at market work or in household production increases time stress for each spouse, with market work being especially stressful. (Given a fixed time budget, this means that shifting away from leisure or personal time increases time pressure.) A higher hourly wage appears to have no impact on time stress in these estimates, but among women, who do most of a household's purchasing, having a higher-earning husband or greater unearned income increases time stress, providing some support for the idea that households combine time and goods. For both spouses, being in good health reduces both time and financial stress, presumably by adding to the efficiency of household production, with effects that are not statistically different between husbands and wives.[13]

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[12] Also included are vectors of indicators of the number and ages of other children in the household (0–4, excluding the newborn, 5–10, 11–15, 16–18), the respondent's and spouse's ages (31–40, 41+), and year indicators. Experiments with individual years of spouses' ages yielded estimates of the effect of a birth on time and financial stress that were almost identical to those in the Table, both here and in the regressions presented in Tables 4, 7. We also include, as per the theoretical motivation, lagged values of the other three stress measures (e.g., in the case of husband's time stress, the wife's time stress and both spouses' financial stress).

[13] Some direct evidence supporting this assertion is provided by Podor and Halliday (2012).

**Table 4**

LS estimates of the effects of a birth on stress, SOEP[a] (N=7525).

| Independent variable: | Time stress (5 to 1) | | Financial stress (5 to 1) | |
|---|---|---|---|---|
| | Husband | Wife | Husband | Wife |
| Lagged stress (own) | 0.310 | 0.303 | 0.368 | 0.319 |
| | (0.018) | (0.020) | (0.024) | (0.021) |
| Birth in past year | 0.052 | 0.212 | 0.012 | 0.014 |
| | (0.051) | (0.058) | (0.051) | (0.055) |
| Very good or good health | −0.216 | −0.225 | −0.176 | −0.209 |
| | (0.029) | (0.034) | (0.031) | (0.031) |
| Work and commute time/week (own) | 0.015 | 0.012 | −0.006 | 0.0004 |
| | (0.001) | (0.002) | (0.001) | (0.0015) |
| Home production/weekday (own) | 0.003 | 0.017 | 0.009 | 0.0009 |
| | (0.006) | (0.003) | (0.006) | (0.0035) |
| Earnings (own) | 0.080 | 0.129 | −0.302 | −0.291 |
| | (0.026) | (0.064) | (0.046) | (0.075 |
| Work and commute time/week (partner) | −0.001 | 0.0003 | −0.001 | −0.004 |
| | (0.001) | (0.0012) | (0.001) | (0.001) |
| Home production/weekday (partner) | 0.0005 | −0.012 | 0.004 | 0.002 |
| | (0.003) | (0.008) | (0.003) | (0.006) |
| Earnings (partner) | 0.103 | 0.046 | −0.165 | −0.250 |
| | (0.052) | (0.026) | (0.070) | (0.041) |
| Unearned income/week | −0.073 | −0.009 | 0.124 | 0.128 |
| | (0.036) | (0.040) | (0.057) | (0.042) |
| $R^2$ | 0.248 | 0.231 | 0.404 | 0.386 |

[a] Also includes all three other lagged stress measures, a vector of measures of numbers and ages of children, year indicators and indicators of the respondent's and spouse's decadal ages (31–40 and 41+).

A birth significantly increases the perceived time stress of both husbands and wives. The impact, however, is three times greater on the wife's time stress than on her husband's, confirming the evidence from the changes in time stress shown in Table 2. Independent of the wife's greater shift from leisure/personal time to household production that raises her time pressure when a child is born (since the equation held the allocation of time constant), the very fact of the birth has a much larger effect on the time pressure that she perceives than on her husband's.

The changes in Table 2 suggested that both husbands and wives perceive additional financial stress with a birth. Holding time allocation and full incomes constant this conclusion remains, although neither effect is strongly significant statistically. The theoretical motivation in Section 2 suggested that the spouses' views of their financial stress will respond identically to a birth. Jointly estimating the equations describing their perceived financial stress, we cannot reject the hypothesis that the responses are equal (t=0.15). The main conclusion here is that a birth causes increases in both spouses' perceptions of financial stress, with an insignificantly larger response in the wife's than the husband's.

It is well known that women's time in the market and in home production responds to a birth (by decreasing and increasing respectively), so that the impacts of time use on stress are quite likely in part generated by the birth itself. To circumvent what is essentially a problem of spurious correlation, we re-estimate the models in Table 3 without the time-use variables. The impacts of a birth on husbands' time stress and both spouses' financial stress are essentially unaffected by this deletion. The parameter estimate on wives' time stress drops from +0.254 to +0.214, an insignificant decline and one that still leaves the wife's response significantly above the husband's. If we drop all controls except the lagged values of the stress measures, the indicators of the spouses' ages, and the year indicators, the estimated impacts of a birth on the husband's (wife's) time stress become +0.060 (+0.136), and on their financial stress +0.079 (+0.152). The overall conclusion is that relatively little of the impact of the birth works through a re-allocation of time. Most is inherent in the changed circumstances in the nature of the household's combination of goods and time that are generated by the addition of a child, circumstances that clearly increase the wife's time stress, and probably her financial stress, more than her husband's.

Table 4 presents the same estimates for the SOEP sample. Unsurprisingly, given biennial data, the sizes of the impacts of lagged stress are smaller and of lower statistical significance than those in Table 3. More important, while the birth has a large and significant positive impact on the wife's time stress, unlike in the HILDA Survey its impact on her husband's time

stress is not statistically significant. Neither spouse's financial stress is significantly affected by the birth, however, and both impacts are tiny.[14]

Again we find that an extra hour of market work per week raises both spouses' perceived time stress; but while it has significant negative effects on the husband's perceived financial stress, it has no impact on the wife's. Consistent with the role of the husband as the major earner in most couples, his financial stress is barely affected when his wife works more, while hers decreases substantially when her husband works more hours (at the same hourly earnings). Additional time spent in home production raises the wife's time stress. Given each spouse's time use, when either spouse earns more per hour (has a higher full income) the time stress of each spouse increases, although not statistically significantly; and unsurprisingly each spouse's financial stress diminishes significantly. The only surprising result in Table 4 is the negative (but statistically insignificant) impact of additional unearned income on time stress, and its positive impact on financial stress. As in the HILDA Survey, good health reduces both time and financial stress, and the sizes of these effects for husbands and wives are not statistically different.

Excluding the time-use measures hardly alters the estimated parameters on the indicator of a birth in the equations describing time stress or financial stress. In the former the estimate for men rises slightly to +0.073, while for women it falls slightly to +0.196. The estimates for this indicator in the financial stress equation both remain tiny and statistically insignificant. Deleting all the controls except the indicators for year and for respondents' ages, the impact on men's time stress changes little (+0.050), while that for women remains statistically significant but falls dramatically (+0.086).[15]

The increased stress felt by new parents may be greater among first-time parents than others. To examine this possibility we add an indicator for first births to all the equations. In the equations describing time stress in the HILDA Survey the coefficients on this indicator were −0.010 (s.e.=0.038) and −0.004 (s.e.=0.040) for men and women respectively. In the equations describing financial stress their counterparts were −0.063 (s.e.=0.038) and 0.031 (s.e.=0.041). In the SOEP the extra impacts of a first child on time stress were −0.043 (s.e.=0.049) for husbands and −0.052 (s.e.=0.056) for wives. For financial stress the additional impacts were 0.037 (s.e.=0.051) and −0.013 (s.e.=0.051). There is no consistent evidence that a first birth adds more to either parent's time or financial stress than do subsequent births.

Do the changes in time and financial stress occasioned by births depend on the presence of older children in the household, and are these effects different for fathers and mothers? We interact the birth indicator with the vector of indicators for older children and re-estimate the time and financial stress models for husbands and wives. In the HILDA Survey these interactions (four in each model) are neither statistically significant as a group nor individually in describing time stress, but the impacts on both husbands' and wives' expressed financial stress are significantly affected by the presence of other children. Having a primary-school age child reduces the perceived financial stress occasioned by a birth, while having a teenager raises it. In the SOEP the presence of older children does not interact significantly with a birth to influence financial stress; but when a child under age 5 is present, a birth increases the time stress that the mother feels following that birth. The estimates show that the effects of a birth on time stress do not vary much with the ages or numbers of older children present in the household, although there is some evidence of a greater increase in time stress among mothers if another young child is present.

As noted earlier, one spouse's idiosyncratic responses to a birth may interact with the other's, and each spouse's perceived time pressure may be related to his or her perceived financial stress. Since the equations include all the same variables, the only issue here is the extent to which the errors in the four equations are correlated. In both samples, once we account for the X variables, the four lagged measures of stress and the birth indicator, the only significant correlations are between the spouses' financial stress (r =+0.28 in the Australian data, and r =+0.36 in the German data) and between their time stress in the SOEP (r =+0.19).[16]

The presence of the pre-birth "Ashenfelter dip" in expressed time stress, especially among wives, could be at least partly responsible for the estimated impacts of a birth on time stress. One way to circumvent this problem is to estimate the models without any lagged measures of time stress, but including person fixed effects. The estimated impact of a birth then becomes the difference between the stress measure immediately after a birth and its person-specific average over the entire panel, adjusted for current measures of time use, earnings and unearned income, health and family structure. Estimating these fixed-effects models for Australia yields an impact of a birth on husbands' time stress of +0.113 (s.e.=0.026), and on wives' time stress of +0.260 (s.e.=0.028). For Germany the analogous fixed-effects estimates are +0.068 (s.e.=0.034) for husbands and +0.246 (s.e.=0.034) for wives. These estimates differ little from those shown in Tables 3, 4. The results also differ little if we estimate fixed-effects ordered probit models. As before, a birth increases mothers' time stress much more than fathers'.

A potential difficulty with using fixed-effects estimation is that the impact of a birth on time stress may remain high for several years after the birth, as shown in Fig. 1. An alternative approach to handling the dip (at the cost of shortening the sample period and losing observations) is to use longer lags in the stress measures, so that the comparisons are to earlier

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[14] Ordered probit estimates of the four specifications reported in Table 4 yield similar results. The impacts of a birth on each spouse's financial stress are statistically insignificant, as is the impact on the husband's time stress, while the effect on the wife's time stress is highly significant and positive. As in the HILDA Survey estimates, the average derivatives differed only very slightly from the OLS estimates.

[15] Alternatively, one can expand the time measures by adding indicators for zero work hours for each spouse. Doing so very slightly increases the estimated impacts of a birth on time stress for each spouse in both data sets, and very slightly decreases the estimated impacts on financial stress.

[16] These conclusions do not change qualitatively if we exclude the time-use measures or, indeed, all the other controls from the basic equations.

**Table 5**
Lag structure of stress in response to the addition of a child[a].

| Years after birth: | Response in standard-deviation units of stress | | | |
| | Husbands | | Wives | |
| | Time stress | Financial stress | Time stress | Financial stress |
|---|---|---|---|---|
| **HILDA** | | | | |
| 0–1 | 0.080 | 0.062 | 0.224 | 0.071 |
| | (0.028) | (0.040) | (0.035) | (0.071) |
| 1–2 | 0.032 | 0.054 | 0.119 | 0.028 |
| | (0.021) | (0.049) | (0.039) | (0.046) |
| 2–3 | 0.081 | 0.000 | 0.124 | −0.029 |
| | (0.047) | (0.068) | (0.030) | (0.071) |
| 3–4 | 0.051 | 0.017 | 0.157 | 0.000 |
| | (0.070) | (0.094) | (0.064) | (0.093) |
| **SOEP** | | | | |
| 0–2 | 0.050 | 0.013 | 0.202 | 0.015 |
| | (0.049) | (0.053) | (0.055) | (0.058) |
| 2–4 | −0.083 | 0.163 | 0.129 | 0.135 |
| | (0.117) | (0.108) | (0.149) | (0.113) |

[a] Based on LS coefficient estimates. Each underlying equation contains current values of all the regressors underlying the estimates in Tables 3a and 3b, except that it includes the lagged stress measures the year before the birth (two years in the SOEP). The equations for years after the initial year are restricted to couples who did not experience a second birth in the interval.

expressions of stress rather than merely to the previous year's (or in the SOEP, the previous biennium's). Re-estimating the models in Table 3 by adding two- and three-year lagged measures of stress, the estimated impact of a birth on husbands' time stress increases to +0.134 (s.e.=0.044), while that on wives' falls to +0.153 (s.e.=0.049). In the SOEP we add lagged measures of stress from the interview four years before the year after the birth, with the resulting estimated impacts of the birth on time stress equalling +0.039 (s.e.=0.043) among husbands, and +0.176 (s.e.=0.044) among wives.

These two methods to account for the drop in perceived time stress during the year ending before the decision to have the child yield somewhat different results. The overall conclusion, however, is that the implied significantly positive impact of the birth on time stress is robust, and that this effect remains greater on the wife's time stress than the husband's.

Does the effect of a birth on time and financial pressure increase or diminish over time? In other words, are the effects that we have demonstrated temporary and caused by the birth, or do they represent the persistent stress costs of a child? To answer this question for Australia we estimate the same models as presented in Table 3, except that we include lagged terms for successively two, three and four years in the birth indicator and in the stress measures. We restrict the sample to couples that had no additional birth, so that we are examining how a birth between Years t and t+1 affects stress at Years t+1 (the results in Table 3), t+2, t+3 and t+4. All estimates include the same other current-period controls that were included in the specifications underlying the results in Table 3.

The estimates are reported in the top part of Table 5, measured in standard-deviation units of stress. While the estimated effects on time stress fluctuate from year to year, with generally smaller effects the more distant in the past the birth is, they remain positive, larger among wives than husbands, and statistically significant among wives. The initial effects on financial stress diminish and are nearly zero two years after the birth. The general conclusion here is that, at least for the four post-birth years that the sample size allows us to follow these couples, time stress, especially the wife's, remains above what it was before the birth, while the additional financial stress essentially disappears.

With biennial data in the SOEP the specification of the lag structure must differ, since taking more than two lags would remove most observations. Accordingly, in the bottom row of the bottom panel of Table 5 we report the estimated (in standard-deviation units) impacts of a birth between Years t and t+2 on stress at Year t+4, including lagged stress measures from Year t and all the current-period controls. The upper row in this panel converts the estimates from Table 4 into standard-deviation units. Between two and four years after the birth none of the effects on stress are statistically significant; the wife's time stress remains, however, substantially positively affected, and both spouses' financial stress is higher than before the birth.

Not surprisingly there are some major differences in the results between the two data sets. We can examine the extent to which the differing frequencies of the data on stress generates the different results by aggregating births in the HILDA Survey over two years and re-estimating the models, using the same controls and two-year lags in stress. Given this temporal aggregation, we lose nearly half the observations (but none of the births), as we are only using observations from 2004, 2006, …, 2012. The results of estimating these temporally aggregated models look somewhat like those reported in Table 3, although the coefficient on births describing wives' time stress is somewhat reduced (but remains statistically significant

and greater than the effect on husbands' time stress). The difference in the frequency of the questions on stress between the two panel data sets explains some of the differences in the results across the two countries/data sets but far from all.

The results may also differ because the questions eliciting time stress and the measures of time inputs differ across the surveys. We account for those discrepancies by including an indicator of whether the stress measures in the SOEP are elicited by an interviewer or are responses to a self-administered questionnaire. Those respondents who were interviewed express significantly less stress on both dimensions; but their time and financial stress respond to a birth almost identically to those of respondents who completed a questionnaire.[17]

There is a remarkably consistent pattern throughout the results: A birth initially generates time stress in the new mother, and that stress persists for at least four years. Moreover, it is greater than the new father's additional time stress, which in any case does not persist. There is weaker evidence of an increase in perceived financial stress felt by either spouse.[18]

## 6. Experimenting with the endogeneity of a birth

While we have argued that selectivity into child-bearing will bias downward estimates of the impact of a birth on time and financial stress, we cannot demonstrate that proposition empirically. It is a sensible theoretical assertion about behavior. Our estimates would thus be even more convincing if we could find a satisfactory instrument for birth. Regrettably, neither of the data sets has any other variables that one could not easily argue also affect time and/or financial stress directly, and other variables that might predict birth (age, number of children of various ages, spouses' earnings, and time allocation) are also predictors of time/financial stress (and are included in the estimates of (3a)–(3c)). The finding of a pre-birth dip in women's time stress, however, might make the dip itself an appropriate instrument to identify a five-equation model of this process (describing each spouse's time and financial stress and also the birth).

The pre-birth drop in women's time stress may be behavioral. As implied in (5), unusually low time and financial stress should induce couples to select into the population of new parents. There is also biomedical evidence that women with low stress, as measured by low values of a particular biological marker, are more fecund (Louis et al., 2011). While we cannot distinguish the behavioral from the biological in either data set, the two effects work in the same direction.

Using the HILDA Survey we estimated an equation describing the probability of a birth that included the lagged change in each spouse's time and financial stress, plus the lagged indicators of the number of children in each of the four age categories.[19] In a linear-probability model the parameter estimates on the husband's and wife's lagged change in time stress are +0.0077 (s.e.=0.0044) and −0.0170 (s.e.=0.0044); those on the husband's and wife's lagged change in financial stress are −0.0098 (s.e.=0.0043) and −0.0012 (s.e.=0.0042).

Observing stress only biennially in the SOEP makes that data set a weaker candidate for investigating this predictor; and Fig. 2 showed unsurprisingly that the dip in women's time stress between time periods t-4 and t-2 was much smaller than the dip observed between t-2 and t-1 in Australia. Nonetheless, we used the SOEP to estimate a linear model describing the probability of a birth as a function of each spouse's changes in time and financial stress between periods t-4 and t-2 (i.e., including two measures of lagged changes in stress). The estimated impacts on the probability of a birth were all small and statistically insignificant, and were unexpectedly positive.

Regrettably in both data sets the predictive power of the lagged measures of stress is quite weak: In Australia the adjusted $R^2$ in predicting whether a birth occurs is only 0.050, while in the SOEP it is 0.024. The lagged stress terms would be very weak instruments, so we do not go further and use them to endogenize births. Nonetheless, the findings here are fascinating, suggesting in the HILDA Survey that declines in the wife's time stress and in her husband's financial stress help induce the couple to have a child.

## 7. Emptying the nest

The theoretical motivation in Section 2 was based on the addition of a child and demonstrated how that demographic change would cause the time and goods constraints facing the household to bind more tightly. The reverse change, the departure of a child, should have the reverse effect: It should decrease the tightness of the constraints and reduce measures of their empirical analogues—perceived time and financial stress. We investigate whether these reverse effects exist and are equal but of opposite sign to those demonstrated above.[20]

Because very few children depart their parents' households before the mother reaches age 45, we expand both samples by removing the restrictions on the mother's age. This expansion of the sample changes the averages of the crucial outcomes

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[17] Another set of possible causes of the differences involves different policies on child care and family subsidies. While with two observations we cannot examine these possibilities, we did consider how an increase in the generosity of child payments in Germany after 2007 might have affected the estimates. Perhaps because of the resulting small sample sizes, or perhaps because it actually had no effect, when we disaggregate the SOEP sample into pre- and post-2007, we find no differences in the estimated impacts of a birth on time stress.

[18] Our findings are captured in a letter from a mother of two pre-school children (July 5, 2002, from Hannah Ebin): "With the kids and the house, I often feel I have four hours of tasks and only two hours to do them in."

[19] The parameter estimates change minutely if we add each spouse's earnings and the household's unearned income to the specification.

[20] As with the impact of a birth on a couple's happiness, the impact of a child's departure on happiness has also been examined (Krekel, 2013).

**Table 6**

Year-to-year transition matrices on stress, with or without child departures, HILDA 2001–12, SOEP 2002–12.

| No departure:<br>Departure: | HILDA<br>(N=23,869)<br>(N=987) | SOEP<br>(N=19,039)<br>(N=1214) | HILDA<br>(N=23,608)<br>(N=987) | SOEP<br>(N=18,968)<br>(N=1214) |
|---|---|---|---|---|
| | **Time Stress** | | | |
| **Change in Stress** | **Men, No Departure** | | **Women, No Departure** | |
| Increase | 20.8 | 26.4 | 21.4 | 27.5 |
| Same | 56.6 | 45.9 | 55.5 | 45.3 |
| Decrease | 22.6 | 27.7 | 23.1 | 27.2 |
| | **Men, Departure** | | **Women, Departure** | |
| Increase | 19.2 | 26.3 | 17.7 | 24.3 |
| Same | 57.2 | 45.3 | 57.5 | 46.7 |
| Decrease | 23.6 | 28.4 | 24.8 | 29.0 |
| | **Financial Stress** | | | |
| **Change in Stress** | **Men, No Departure** | | **Women, No Departure** | |
| Increase | 22.2 | 25.9 | 22.4 | 25.3 |
| Same | 54.0 | 50.4 | 52.9 | 50.1 |
| Decrease | 23.8 | 23.7 | 24.7 | 24.6 |
| | **Men, Departure** | | **Women, Departure** | |
| Increase | 18.8 | 25.2 | 21.2 | 24.9 |
| Same | 56.3 | 48.2 | 54.9 | 49.3 |
| Decrease | 24.9 | 26.6 | 23.9 | 25.8 |
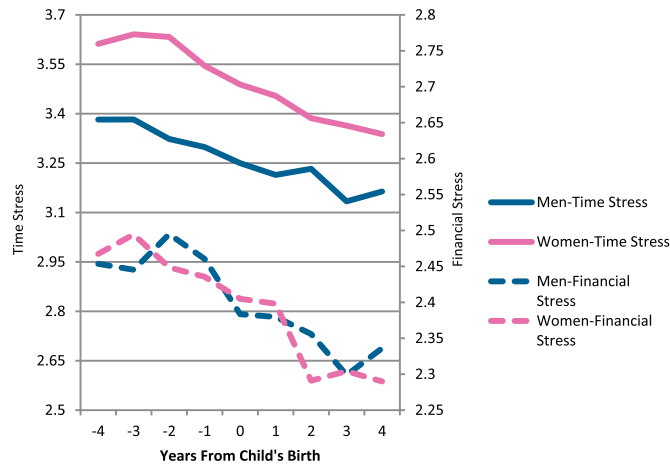


**Fig. 3.** Time and financial stress before and after departure of a child, HILDA 2001-12.

substantially (compared to the averages shown in Table 1), decreasing them in all cases.[21] In the Australian data the average time stress is 3.10 and 3.31 for husbands and wives respectively, while the average financial stress is 2.36 and 2.32. In the SOEP the means of time stress are 2.65 and 2.84, and of financial stress are 2.61 and 2.52.

In Table 6 we present statistics describing changes in husbands' and wives' time and financial stress depending on whether a child departed the household that year (within two years in the SOEP), thus listing the results in the same way as those for births in Table 2. In seven of eight comparisons (husbands-wives, HILDA-SOEP, time and financial stress) individuals whose child left the household were more likely to experience a decrease in stress, and less likely to experience an increase, than those whose child did not leave the household. The only exception is in the distributions of changes in financial stress among wives in the HILDA Survey.

In general, the results mirror those for births in Table 2: A departure generally reduces stress. The differences in changes in stress between those who do or do not experience the demographic event, however, are much smaller than they were for births. Indeed, the trivariate distributions are not statistically different from each other for time stress among men and financial stress among women in either the Australian or the German data. Wives' time stress decreases more than husbands' when a child leaves the household. The differences in the impacts of births and departures on time stress are more

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[21] Without this expansion of the sample sizes we would observe very few departures of children, and those few would be highly non-randomly selected. Changing the sample definition obviously alters the age mix of the respondents. Thus in the samples used earlier the average ages of wives in the HILDA Survey and the SOEP were 35 and 37 respectively. Removing the age restriction raises these respective averages to 48 and 52. Throughout this section we also exclude observations for years (biennia in the SOEP) in which a couple experienced a birth.
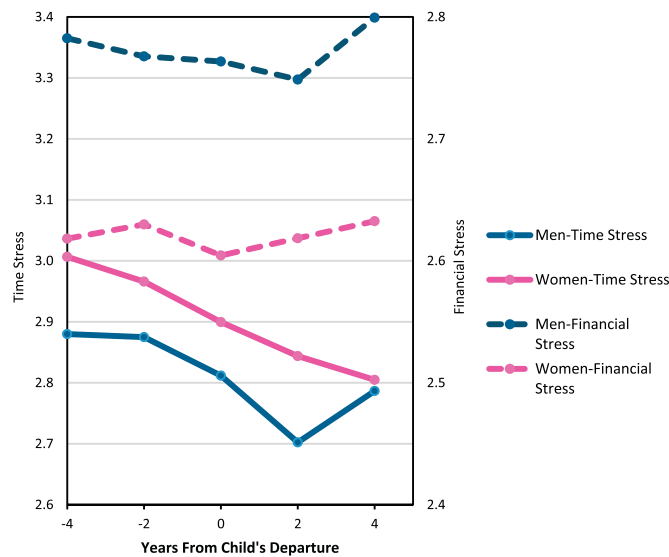
**Fig. 4.** Time and Financial stress before and after departure of a child, SOEP 2002–12.

**Table 7**
LS estimates of effects on stress in response to the departure of a child[a].

| | Response in standard-deviation units of stress | | | |
| --- | --- | --- | --- | --- |
| | **Husbands** | | **Wives** | |
| | Time stress | Financial stress | Time stress | Financial stress |
| **HILDA** | | | | |
| | −0.038 | −0.005 | −0.057 | 0.042 |
| | (0.030) | (0.040) | (0.030) | (0.038) |
| **SOEP** | | | | |
| | 0.0001 | 0.071 | − 0.041 | 0.026 |
| | (0.039) | (0.040) | (0.035) | (0.035) |

[a] The underlying equations include all the variables in the specifications reported in Tables 3 and 4, except that the vectors of indicators of respondents' and spouses' ages denote ages 41–50 and 50+.

pronounced among wives, but even there the magnitudes of the differences and their statistical significance are far below those of their counterparts in Table 2.[22]

We can explore the dynamics of time stress around this demographic event, as we did for births in Figs. 1 and 2, by considering averages of time and financial stress +/- four years around a child's departure. The results are shown in Figs. 3 and 4, constructed exactly like their analogues for births. The first thing to note is that, unlike for births in the HILDA Survey, here we find no pre-event dip in either time or financial stress. Rather, in both surveys and for both husbands and wives, time stress appears to diminish more or less steadily from at least two years before a child departs the household; and it continues decreasing in all cases for two years after. In both surveys, and for both spouses, financial stress also decreases from at least two years before the event; but the decrease stops or even reverses itself within two years after the departure.

Going still further, we estimate equations with specifications like those reported in Tables 3, 4, except that here the variable of interest is the departure of a child. To save space, in Table 7 we report only the least-squares estimates of the impacts of the departure on the measures of each spouse's time and financial stress. While in both surveys the wife's time stress decreases with the child's departure, the decreases are small compared to the increases shown in Tables 3, 4, and they are not (quite) statistically significant.

While these results weakly corroborate the prediction that having a child leave the house loosens time constraints, they suggest that the responses to what might seem like opposing events are asymmetric. Births tighten the constraints much more than departures loosen them, especially among wives and especially for their time stress. Moreover, the results imply that, unlike births, departures are associated with a nearly steady diminution of time stress both before and after the event, with generally similar effects on financial stress.

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[22] Restricting departures to those that result in an empty nest (where no children remain the household) does not alter the conclusion. The differences between those with and without a final departure remain small.

## 8. Conclusions and implications

Using data from longitudinal surveys for Australia and Germany, we have demonstrated that a birth causes a rise in mothers' time stress that is not dissipated over the first few years of her child's life. The increase in fathers' time stress is much smaller; and we find some weak evidence that a birth increases spouses' financial stress, with weak evidence that this increase is greater among wives than husbands. This demonstration is not that births affect such inchoate concepts as well-being or life satisfaction. Rather, by analogizing time stress to the Lagrangean multiplier on each spouse's time constraint, and financial stress to the multiplier on the household's goods constraint, the results are consistent with a model with households maximizing their utility given their full income.

The magnitudes of the impacts of a birth on time stress are not insubstantial, especially for a new mother. The immediate impact of a birth is to raise new mothers' time stress by roughly 0.2 standard deviations in both the Australian and the German data. The effects on husbands' time stress are much smaller, but still large enough to raise it by several percentiles.

The results also provide evidence of the expected reverse pattern of responses to demographic events, in that a child's departure from the household generally reduces spouses' time stress. The effect is larger for the mother than the father, but these negative effects are much smaller than the positive effects of a birth. Implicitly, the pleasure of having children is sufficient to offset the implicit additional lifetime stress that they cause parents. This is obvious; but the novelty here is the demonstration of the magnitudes and time paths of that stress.

Because of the limitations of the data sets—and especially the relatively short duration of the panels—our ability to examine the dynamic effects of births and of departures from the household on time and financial stress within a general model of household production has been limited. While this research suggests that having children generates a permanent lifetime increase in perceived stress, especially wives', the long-term effects of a birth on stress can only be analyzed with longer panels than are currently available. That and linking the impacts of births on time and financial stress to spouses' bargaining behavior in the household remain potentially fruitful avenues for additional study.

## Acknowledgements

## Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at http://dx.doi.org/10.1016/j.euroecorev.2016.12.012.

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