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Research Article

Spousal separation, selectivity and contextual effects: Exploring the relationship between international labour migration and fertility in post-Soviet Tajikistan

David Clifford

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Spousal separation, selectivity and contextual effects: Exploring the relationship between international labour migration and fertility in post-Soviet Tajikistan

David Clifford[1]

Abstract

This paper contributes to the sparse literature about the impact of temporary migration on fertility in sending regions. It examines the case of male labour migration from post-Soviet Tajikistan, a significant and relatively recent phenomenon. Fertility and migration models are solved simultaneously to account for cross-process correlation. There is clear evidence for a short-term disruptive effect of spousal separation, but it is too early to assess the implications for completed fertility. While there is no evidence for unobserved selectivity at the couple level, there is a significant positive covariance between the migration and fertility processes at the community level. Rather than reflecting the contextual influence of community migration patterns on fertility, this positive covariance may reflect selectivity: given that labour migration in Tajikistan is prompted by economic need, poorer communities – in which women tend to have higher than average fertility - may also be expected to display an above average prevalence of labour migration.

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1. Introduction

This paper examines the relationship between men's temporary international labour migration from Tajikistan and their spouses' fertility. There is an established literature examining the links between spatial mobility and childbearing, including a number of papers in a recent special issue of *Demographic Research* (Volume 17). However, most of this research has tended to focus on the effects of long-term moves. As Lindstrom and Giorguli Saucedo (2002:1341) point out, 'the impact of temporary migration on fertility in origin areas has received little attention', despite the importance of this form of migration in many parts of the world. In Central Asia, as in parts of Eastern Europe, temporary international labour migration has become one of the defining features of the region's post-Soviet demography. In Tajikistan, this has been particularly significant: to illustrate, Mughal (2007:30) estimates that remittances sent by absent international migrants to families represented over a quarter of Tajikistan's Gross Domestic Product in 2004; globally, only in Tonga and Moldova do remittances make up a bigger share. According to a more recent estimate, remittances made up 46% of GDP in Tajikistan in 2008, a higher figure than for any other country (Ratha, Mohapatra, and Xu 2008).

Most studies linking migration and childbearing have tended to treat one as an important 'parallel career' in shaping the other. Here, following Kulu and Milewski's (2007) advice, the approach is to examine the interdependencies between the two. Joint modelling of fertility and migration equations not only provides an estimate of the influence of spousal separation on fertility, but also some insight into the extent to which migrants are selected for characteristics associated with fertility.

2. Theory: Temporary migration and childbearing

Four areas of the migration-fertility relationship are of particular relevance to the study of temporary migration and childbearing.

2.1 Disruption

The potentially disruptive influence of spousal separation on fertility is well recognised. Mathematical models have shown the potential for repeated seasonal migration to lower birth rates, analogous to reducing fecundability to a new lower constant level (Bongaarts and Potter 1979; Menken 1979). The 'efficiency' of spousal separation in reducing natural marital fertility is known to vary according to length of separation, length of postpartum amenorrhea, and fecundability (Millman and Potter 1984). Meanwhile, we would expect the cumulative impact of spousal separation to be greatest in areas of relatively high fertility and low modern contraceptive prevalence. However, this has been difficult to ascertain as there have not been many empirical illustrations of the effect of separation on fertility in particular populations. At an aggregate level, van de Walle (1975) links the relatively low levels of marital fertility in nineteenth century Ticino, Switzerland to the regular seasonal pattern of male absence. Massey and Mullan (1984) use cross-sectional individual-level data from a rural town in Mexico to show that women with husbands absent through migration (leaving at some point between 1976 and 1978) were significantly less likely to have a child aged one or two (born in 1976 and 1977), while Chen et al. (1974) argue that monthly variation in the number of days males are absent partially explains the striking seasonal pattern in births found in Matlab, Bangladesh over the two-year observation period.

Empirical studies into the effect of separation are helpful in illustrating the impact on annual birth probabilities of a particular temporal pattern of male absence. They also provide insights into the possible longer-term implications of separation for fertility which purely mathematical studies, given the complexity of human behaviour, cannot. For example, as Millman and Potter (1984) acknowledge, their simulation does not allow for a potential increase in the frequency of intercourse after separation has ended, and therefore a higher post-reunion conception rate relative to a non-separation scenario, which might partially offset the effect of separation. It also does not allow for any dependency between the timing of separation and a woman's reproductive status. This may bias estimates of the impact of separation on fertility if, for example, migration is postponed - or conversely, in order to meet current income deficits the risk of migration increases - following a birth. Overall, our understanding of the relationship between temporary migration and fertility would benefit from more empirical work to complement and inform mathematical simulations – but such work has been limited, until recently, by a lack of individual-level data with information on both migration and fertility behaviour over time.

Lindstrom and Giorguli Saucedo's (2002; 2007) research into the interrelationships between Mexico-US migration and fertility is therefore particularly valuable. They use data from the Mexican Migration Project, containing retrospective migration and fertility histories for both Mexicans in the sending communities and those in the US areas in which they tend to settle. They show that, contrary to the independence assumption in Millman and Potter's (1984) simulations, the likelihood of husband's migration is greatest in the year during which a birth occurs, and in the years immediately following. They provide clear evidence of a disruptive effect on fertility: in the Mexico sample, spousal separation of 4-7 months lowers the odds of a birth in the subsequent year by 15%, while a separation of 8-12 months lowers the odds by 32%.

Importantly, however, despite this short-term disruption, there is no evidence to suggest a significant effect of separation on cumulated fertility. Lindstrom and Giorguli Saucedo conclude that Mexican couples are able to make up for lost reproductive time following the periods of separation. The lack of impact on the total number of births also reflects the particular pattern of temporal absence: most separations are relatively short in duration and repeated long separations are unusual.

2.2 Assimilation and the effect of remittances

Much of the literature relating long-term migration to fertility behaviour evaluates the relative importance of socialisation and adaptation in a particular context. From the socialisation perspective, migrant fertility is heavily influenced by preferences and behaviour in the origin environment; in contrast, the adaptation/assimilation hypothesis argues that migrant fertility comes to resemble behaviour at the destination. Lindstrom and Giorguli Saucedo (2002) distinguish the importance of adaptation, rooted in economic theories of fertility stressing the role of income and the relative costs of and preferences for children in decisions regarding family size (Becker 1991), from that of assimilation, the gradual process in which migrants adopt the norms and cultural values of the population at destination. In the case of temporary migration, the former may influence behaviour during the temporary stay within the different economic context at the destination, but the assimilation of values has the potential for a more long-lasting impact on fertility behaviour even after return to the origin environment. Indeed, they find evidence that, among couples in their Mexico sample and after controlling for the effects of separation, each additional year of women's cumulated US migration experience lowers the odds of a birth in a given year by 4%.

Interestingly, any effect of men's cumulated migration experience on fertility is in the opposite direction. Therefore, to the extent to which the assimilation of cultural values serves to reduce the fertility of temporary migrants, it is specifically women's migration experience that seems to be significant. This is unlikely to reflect an inability of male migrants, with any newly assimilated values, to change fertility behaviour at home when faced with conflicting desires from their non-migrating wife. Indeed, in many gendered communities husbands exercise control over their wives' contraceptive and fertility behaviour (Casterline, Perez, and Biddlecom 1997; Razzaque 1999; Mason and Smith 2000). More likely is that while Mexican women who experience living and working in the US change their attitudes and ideas about childbearing and family size, men don't change to the same extent (Lindstrom and Giorguli Saucedo 2002:1357). A further possibility is that, in the case of male migration, any negative effect of assimilation is outweighed by the positive effect of remittances - removing household economic pressures which would otherwise have discouraged childbearing and reducing their wives' need to work outside the home.

2.3 Contextual influence of community migration patterns

According to the diffusion hypothesis, assimilated cultural values may not only influence individual couple's fertility, but also the behaviour of others in the area to which they return. This theory therefore highlights the 'contextual' influence of migration patterns within a community. The potential importance of diffusion increases with both migration prevalence and the length of history of the migration stream. Further, as Lindstrom and Giorguli Saucedo (2002) show, just as the gender composition is key to the assimilation process, so too it seems to play a key role in diffusion. They find that women living in Mexican communities with a high prevalence of female migration are significantly less likely to give birth in a given year, and have significantly fewer children, than those living in areas with lower rates of female migration. On the other hand, those living in areas with a high prevalence of male migration are more likely to give birth in a given year after controlling for separation effects. High levels of male migration, they argue, may actually serve to strengthen traditional family behaviour in the community. This is consistent with the idea that through transfers to non-recipient households, and through increased ability to invest in local infrastructure, remittances benefit the community as a whole, and not just the household of the migrant. Similarly, Agadjanian et al. (2008) show that high community levels of male migration in rural Mozambique are associated with a higher probability of birth in a given year, and also speculate that migration's economic benefits might serve to 'cement' or strengthen the family system and the community's social fabric.

2.4 Selectivity

Importantly, migrants tend to be selected for certain characteristics associated with fertility. Even before long-term moves, migrant fertility behaviour often mimics the fertility behaviour of women in the migration destination (White, Moreno, and Guo 1995; Chattopadhyay, White, and Debpuur 2006). A recent body of research illustrates how migration itself is often prompted by decisions connected with marriage and family building and that the tendency for women to have elevated first birth risks after internal migration should be understood within this context (Gabrielli, Paterno, and White 2007; Milewski 2007; Nedoluzhko and Andersson 2007). While migrants may be selected for observed characteristics such as marital status, age and educational background, they may also differ in harder to measure characteristics including fertility preferences or openness to innovation (Lindstrom and Giorguli Saucedo 2002). Selection may operate at the community level as well as the couple level if, for example, migration is more prevalent from the poorer communities displaying higher fertility levels.

Importantly, the potential direction of selectivity varies from place to place. On the one hand, migrants may possess motivational characteristics also associated with lower fertility, including a desire for social mobility; on the other, it might be the economically disadvantaged, with a propensity for high fertility, who are more predisposed to migrate (Singley and Landale 1997). Massey and Mullan's (1984) study of migration from Mexico provides an example of the former mode of selection. After controlling for the effects of separation, wives of legal migrants had significantly lower fertility compared to those married to illegal migrants. This they interpret as a reflection of differences of wealth and outlook between the two groups, with the wives of legal migrants having acquired a concept of upward mobility.

2.5 Levels of analysis

Three levels of analysis - couple years nested within couples nested within communities - are relevant when considering the four areas of the migration-fertility relationship. Disruption operates at the couple-year level, as do assimilation and the effect of remittances; the contextual influence of migration patterns operates at the community level; selectivity may operate at the couple and/or community level.

3. Context: fertility in, and labour migration from, Tajikistan

During Soviet times, Tajikistan had the highest fertility of all the Soviet republics, with census data showing the highest average annual rates of population growth in each of the periods 1959-1970, 1970-79 and 1979-1989 (Anderson and Silver 1989). Fertility peaked in the mid-1970s at 6.3 children per woman and subsequently started to decline, mirroring wider Soviet trends, reaching a figure of 5.04 by the time of independence in 1991 (TransMONEE 2006). Despite this decline, by the end of the Soviet era, Tajikistan was still regarded as 'pre-transitional' (Anichkin and Vishnevskii 1992:61). Central Asia had the highest fertility rates in the Soviet Union, with Tajikistan showing the highest rates of all (Turner 1993) and the ideology of large families 'well established' among the local population (Harris 2002:219). In post-Soviet times, total fertility has continued to decline and was estimated at 3.96 for the 2000-02 period[2], but this remains the highest figure across the former Soviet Union. Modern contraceptive prevalence has increased but is still quite low, estimated at 30% of women in union in 1999 (Falkingham 2000), with use confined to women at higher ages and parities. Indeed, given both that the cumulative impact of spousal separation tends to be greatest in areas of relatively high fertility, and that labour migration from Tajikistan is significant, of the ex- socialist and Soviet states in Central Asia and Eastern Europe we might expect Tajikistan to show the most marked fertility response to temporary labour migration.

Recent labour migration should be distinguished from earlier migration movements. Tajikistan was affected by a huge wave of out-migration of the non-ethnically Tajik population in the years before and after independence in 1991. The civil war in the early post-independence years led to the internal displacement of around 500,000-600,000 people, while an estimated 70,000-100,000 fled to Afghanistan (Foroughi 2002; Lynch 2002). Virtually all of these migrants had returned to their permanent place of residence by 1997 (Rowland 2005). But according to Olimova and Bosc (2003), it was not until the mid-1990s that economically-driven 'labour migration' started to emerge – and levels have probably been growing ever since. They estimate that in 26% of all households at least one household member had worked abroad at some point between 2000 and 2003. They identify several types of movement: traders who undertake short-term shuttle tours several times a year; seasonal workers, who return to Tajikistan each winter; and those who work abroad for several years at a time and visit their families infrequently. Both Olimova and Bosc (2003) and Mughal (2007) present data showing that the vast majority of migrants are men of working age who are working in Russia. Mughal argues that this represents a 'brawn' (rather than a 'brain') drain, given that only 7% of the migrants from his survey in the region of Khatlon had tertiary education, compared to around 20% of the working male population as a whole.

The survey data used in this study confirm that couples with a lower educational background are more likely to experience male labour migration in a given year. For the majority of the female population the completion of secondary school represents their highest attainment; correspondingly this represents the educational background of the majority of couples in which the male is absent through migration. Nevertheless, a significantly higher proportion of men whose wives have no, or only primary, education have migrated in a given year than those whose wives have higher education (Table 1)[3]. Women experiencing spousal absence through labour migration in a given year are also,

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[2] This estimate is based on the author's calculations using the birth history component of the 2003 Tajikistan Living Standards Survey (TLSS).

[3] Female education is used to measure couples' educational background because no educational information was collected for household members who had been absent for 12 or more months – so this information is often missing for male migrants.

on average, slightly younger than those whose spouse is present (Figure 1). The survey data also show significant geographical differences in migration, with the Regions of Republican Subordination (RRS) experiencing a much higher propensity for extended spousal absence than other regions (Table 2). Overall urban and rural areas show quite similar levels of migration: in both, the male spouse is absent for six months or more in about 4% of couple years.

Table 1: Proportion of couple years by length of male absence, for different female educational levels

	Spousal absence (months)		
	0-5	6-12	*N*
None/primary/missing	92.8	7.2	*554*
Secondary basic	95.9	4.1	*1,940*
Secondary complete	96.1	3.9	*12,781*
Higher	97.6	2.4	*963*
	96.1	*3.9*	*16,238*

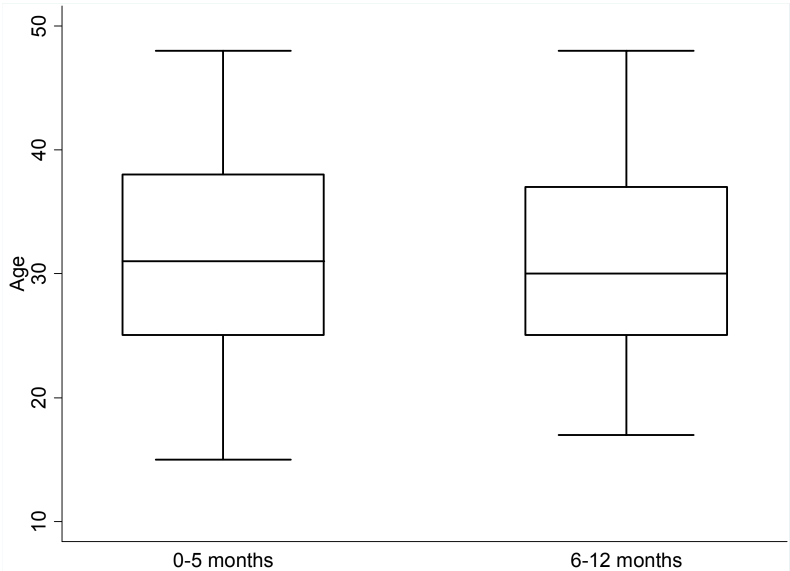
N : number of couple years. Relates to couple years from 1998-2002 inclusive.
Source: author's analysis of Tajikistan Living Standards Survey (2003).

Table 2: Proportion of couple years by length of male absence, for different regions

	Spousal absence (months)		
	0-5	6-12	*N*
Khatlon *(rural)*	98.4	1.6	*3,586*
Khatlon *(urban)*	98.2	1.8	*793*
Regions of Republican Subordination *(rural)*	91.4	8.6	*2,648*
Regions of Republican Subordination *(urban)*	87.8	12.2	*403*
Sogd *(rural)*	96.7	3.3	*3,953*
Sogd *(urban)*	96.9	3.1	*1,351*
Gorno-Badakhshan *(rural)*	98.0	2.0	*1,246*
Gorno-Badakhshan *(urban)*	98.7	1.3	*321*
Dushanbe *(capital; urban)*	95.4	4.6	*1,937*
	96.1	*3.9*	*16,238*

N : Number of couple years. Relates to couple years from 1998-2002 inclusive.
Source: author's analysis of Tajikistan Living Standards Survey (2003).

Figure 1: Boxplot of woman's age, by categories of spousal absence in a particular year



Relates to couple years from 1998-2002 inclusive. Only women aged 15-49 in 2003 were interviewed in the survey.
Source: author's analysis of Tajikistan Living Standards Survey (2003).

The context of the labour migration process has implications for the nature of the migration-fertility relationship in Tajikistan. It is at this stage overwhelmingly sex selective, with very few women working abroad for significant periods and most men travelling alone[4]. The socialisation and adaptation hypotheses, regarding a couple's fertility behaviour at their destination, is therefore less relevant. Perhaps most importantly, and unlike some of the more established labour migration streams analysed in the literature, labour migration from Tajikistan is a relatively new, 'young', phenomenon. Methodologically, therefore, it would be difficult to investigate the negative effect of assimilation (or the positive impact of remittances) net of separation[5].

[4] The TLSS survey data confirm that very few women migrate to work abroad. Of the 3,509 couples analysed, 387 men (11.0%) and 26 women (0.7%) had spent three months or more abroad between 1998 and 2002. Therefore, of those who had spent this amount of time abroad, just 6% were women.
[5] Lindstrom and Giorguli Saucedo (2002) use husband's total US experience, lagged by two years, as a measure of assimilation. This is in a context of a long history of Mexico-US migration; in the Tajik context, with limited potential for the accumulation of labour migration experience, any measure of assimilation is

For these reasons, this paper focuses on examining the importance of the remaining areas – disruption, the contextual influence of community migration patterns, and selectivity – in the Tajik context. Disruption is expected to be an important short-term influence on fertility, particularly given the quite high levels of fertility and low modern contraceptive prevalence. Lindstrom and Giorguli Saucedo (2002; 2007) conclude that the effect of spousal separation on fertility in Mexico is temporary and couples are later able to make up for lost reproductive time; it will be interesting to see whether in Tajikistan, in the relatively short span of years analysed, the couples in which males have spent some time abroad have also been able to compensate for these periods of absence. In terms of contextual influences, since past studies have argued that its effects are strongest in places with a long history of migration and where there is a high prevalence of female migration, we would not expect to find strong evidence for diffusion in Tajikistan. Finally, given the tendency for labour migrants from Tajikistan to be relatively poorly educated, we might expect migrants to be selected for high fertility.

4. Data

This study uses the 2003 Tajikistan Living Standards Survey (TLSS), part of the Living Standards Measurement Study (LSMS) household surveys project overseen by the World Bank. This was a nationally representative survey of 4,160 households across 208 primary sampling units (‘communities’). The survey recorded complete birth histories for women aged 15-49 years, with exact dates of birth, together with the international migration history of each member of the household, providing a valuable chance to link fertility and migration behaviour. The migration history consists of the number of months an individual spent abroad in each of the years from 1998 to 2003 inclusive. A longer history would have been preferable, but given that labour migration is a very recent phenomenon – with movements only starting in the mid-1990s – the survey provides coverage of most of the years of labour migration up to the time of the survey. Pragmatically, too, since migration histories are likely to be recalled with less accuracy than birth histories, restricting retrospective questioning to the five years before the survey may minimise recall error. Importantly, migration histories were collected for each individual irrespective of whether they were currently residing in Tajikistan. If a particular member was currently abroad, another member of the

likely to be confounded with the potentially disruptive effect of separation and any ‘catching up’ in the conception rate following spousal reunion.

household would provide the information on their behalf[6]. Since the focus here is the effect of labour migration on marital fertility, only married couples are included in the analysis. The spouse code in the survey roster was used to link the woman's fertility history with her spouse's migration history, creating a couple year dataset for the years 1998-2002 inclusive. Years from before the couple were married were excluded from analysis[7]. The analysed dataset contains 16,238 couple years from 3,509 couples across 208 communities.

5. Method

Given the lack of empirical research on the impact of temporary migration on fertility in origin areas, this paper examines the relationship between men's international labour migration from Tajikistan and their spouse's fertility. The first step is to examine the potentially disruptive effect of male spousal absence on the odds of conception in a given year. Dates of birth are shifted back nine months to reflect the dates of conception leading to live births. The dependent variable in the fertility model is a binary variable y_{tjk} indicating whether couple j in community k conceived in year t. A multilevel logistic regression model is fitted to allow for the hierarchical structure and to correct the estimated standard errors to allow for the clustering of observations at the couple and community level (Goldstein 2003). The model can be expressed as:

$$\log\left(\frac{p_{tjk}^{(y)}}{1-p_{tjk}^{(y)}}\right) = \gamma_0^{(y)} + \beta^{(y)} x_{tjk}^{(y)} + \gamma z_{tjk} + u_{jk}^{(y)} + v_k^{(y)} \qquad (1)$$

where $p_{tjk}^{(y)}$ is the probability of a conception in a given year, $\gamma_0^{(y)}$ is a constant, z_{tjk} indicates spousal absence with coefficient γ, $x_{tjk}^{(y)}$ represent a vector of controls with coefficients $\beta^{(y)}$, and $u_{jk}^{(y)}$ and $v_k^{(y)}$ are couple and community random effects, assumed to be normally distributed with mean 0 and variances $\sigma_{u(y)}^2$ and $\sigma_{v(y)}^2$ respectively. Controls include the time since union (for the model of conceptions leading to first

[6] Migration histories were only collected for those listed as 'household members' on the household roster. The definition of a household member is not straightforward - and may well have been interpreted in different ways by different households. The potential omission of longer-term labour migrants, particularly if they have stopped sending remittances and failed to maintain contact with the household, is noted. Any such omissions would be expected to lead to an under-estimate of the influence of spousal separation on fertility.

[7] The woman's age x at the survey, and the woman's age at marriage y, are only measured in completed years. The woman's age at t years before the survey is calculated as x-t. Couple years were excluded from the analysis if $y>(x-t)$.

births) or the time since the previous birth (for the model of conceptions leading to higher order births). Apart from educational background, there are no controls for socio-economic status, which is likely to be correlated with both fertility and migration. The survey did collect a wealth of data on household income, consumption and expenditure, but these were not used as covariates since all relate to the period immediately preceding the survey only; Hoem and Kreyenfeld (2006a; 2006b) warn against an anticipatory approach which conditions on the future[8].

Given that migrants may be selected for certain unobserved characteristics associated with fertility, a multi-process (or 'joint 'or 'simultaneous') model is also fitted to allow for the joint determination of fertility and migration processes. This approach has been recently used in the demographic literature to analyse correlated processes like childbearing and union dissolution (Steele et al. 2005; Leone and Hinde 2007), mobility and union dissolution (Boyle et al. 2008) and internal migration and fertility (Kulu 2005). To my knowledge, this is the first time it has been used to analyse the relationship between temporary international labour migration and fertility. An equation predicting spousal migration in a particular year, fitted simultaneously with equation (1), is given by:

$$\log\left(\frac{p_{tjk}^{(z)}}{1-p_{tjk}^{(z)}}\right)=\gamma_0^{(z)}+\beta^{(z)}x_{tjk}^{(z)}+u_{jk}^{(z)}+v_k^{(z)} \qquad (2)$$

where $p_{tjk}^{(z)}$ is the probability of spousal absence in a given year, $x_{tjk}^{(z)}$ represent a vector of controls with coefficients $\beta^{(z)}$, and $u_{jk}^{(z)}$ and $v_k^{(z)}$ are couple and community specific random effects respectively. One of the controls is whether the spouse had migrated the previous calendar year[9]. The model allows for selectivity at the couple and community levels by allowing for cross-process correlation between the random effects at these levels. Thus $(u_{jk}^{(y)}, u_{jk}^{(z)})$ and $(v_k^{(y)}, v_k^{(z)})$ are assumed to follow bivariate normal distributions:

[8] Educational background is also only measured at the time of the survey but, since the vast majority of individuals in union have already completed their education, is included as a time-invariant control.
[9] Since the migration information from 1998 – 2002 in the survey consists of the number of months of absence in each of the five years, rather than spells (start and end dates) of migration episodes, the data are organised by years within couples, rather than migration 'spells' within couples. Equation (2) therefore predicts the log odds of spousal absence through migration in a given year, controlling for spousal absence in the previous calendar year, rather than the log-odds of the hazard of migration at a given time since previous migration. Equation (1) similarly predicts the log-odds of conception in a given year, with a control for time since union/time since previous birth. In order to control for migration behaviour in the previous calendar year, and since no information is provided on migration in 1997, the multiprocess model is fitted for the calendar years 1999-2002 inclusive, not 1998-2002.

$$\begin{bmatrix} u_{jk}^{(y)} \\ u_{jk}^{(z)} \end{bmatrix} \sim \mathrm{N}(0, \Omega_u) \ : \ \Omega_u = \begin{bmatrix} \sigma_{u(y)}^2 & \\ \mathrm{cov}(\sigma_{u(y)}^2, \sigma_{u(z)}^2) & \sigma_{u(z)}^2 \end{bmatrix}$$

$$\begin{bmatrix} v_{k}^{(y)} \\ v_{k}^{(z)} \end{bmatrix} \sim \mathrm{N}(0, \Omega_v) \ : \ \Omega_v = \begin{bmatrix} \sigma_{v(y)}^2 & \\ \mathrm{cov}(\sigma_{v(y)}^2, \sigma_{v(z)}^2) & \sigma_{v(z)}^2 \end{bmatrix}$$

In this way, the extent to which male-migrant couples are selected for unobserved couple-level characteristics associated with fertility can be gauged by examining the direction and significance of the covariance between the u_{jk} terms in the two equations. Similarly, a significant covariance between the v_k terms may be interpreted as evidence for selectivity - this time at the community level. Alternatively, it may be indicative of the contextual influence of community migration patterns on fertility behaviour: a negative covariance, such that after controlling for covariates communities with a relatively high number of temporary migrants also have a relatively low number of conceptions, would be consistent with the diffusion hypothesis; a positive covariance would be consistent with the idea that migration's economic benefits can serve to strengthen the family system. Besides illustrating the importance of selectivity and possible contextual-level effects, the multi-process model has the benefit of providing an estimate of the influence of spousal separation on fertility which is adjusted for selectivity bias at the couple and community levels.

Identification of the multi-process model is achieved through within-couple replication of conception and migration information across years (see Table 3). The model is therefore fitted under the assumption that all sources of correlation between the two processes are at the couple and community levels. Following Steele, Goldstein, and Browne (2004), it is fitted as a multilevel bivariate model by creating a dummy variable indicating the type of response to interact with the covariates of interest. In this case, therefore, for each couple year there are two responses (conception/spousal separation). Estimation is through Markov Chain Monte Carlo (MCMC) methods, using MLwiN version 2.01 (Rasbash et al. 2004)[10]. Browne (2002) provides details of using MCMC methods in MLwiN.

[10] Initially, model parameters are estimated using marginal quasi-likelihood (MQL) methods, then Bayesian MCMC simulation-based methods are used, with the MQL estimates providing starting values. For the single-process logistic models presented here, 80,000 chains are used, with the first 5,000 representing the 'burn-in' period in which draws are discarded before convergence is achieved; for the multiprocess model, 500,000 chains are used, with a burn-in of 20,000 and a thinning factor of 10.

Table 3: Distribution of couples by number of years[a], during 1999-2002 inclusive: a) in which a conception leading to a live birth occurred; b) in which the male was absent for at least six months through labour migration

No. of years	No. of couples a) conception	b)migration
0	1,702	2,776
1	1,083	173
2	277	51
3	9	29
4		42
	3,071	3,071

a Couple years at parity 0 excluded, since the multiprocess model only considers higher order conceptions.
Source: author's analysis of Tajikistan Living Standards Survey (2003).

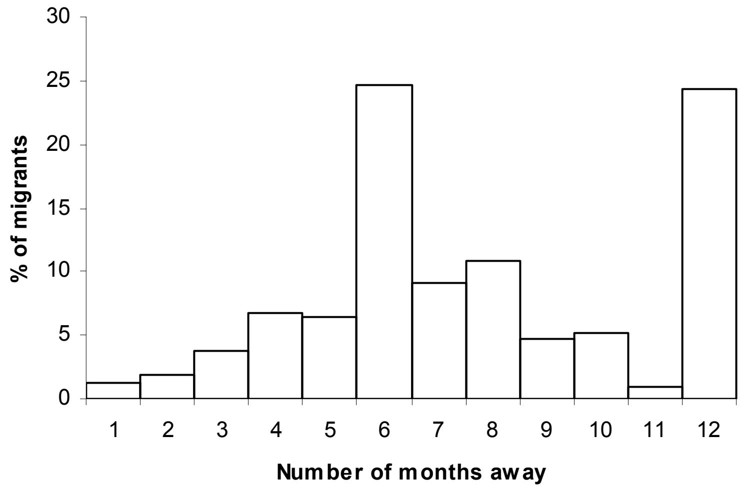
6. Results

Of the 3,509 couples studied, 398 (11.3%) male spouses lived abroad for at least one month during the period from 1998 to 2002. Of the 16,238 couple years analysed, in 798 (4.9%) of them the male spouse was abroad for at least one month in a given year. For these 4.9%, Figure 2 shows the distribution of months away. It is possible that there is some element of respondent digit preference (‘rounding’) for answers of six and 12 months. However, given the previous research of Olimova and Bosc (2003), the overall bimodal pattern probably reflects the real underlying distribution: a peak at six months reflecting seasonal workers, who return to Tajikistan each winter; and the peak at 12 months reflecting those who work abroad for several years at a time and visit their families relatively infrequently.

6.1 Disruption

Table 4 presents results from the single-process model examining the relationship between spousal absence and odds of conception in a given year. The categories chosen for the spousal absence variable reflect the nature of the distribution: months with sparse numbers are grouped together (one to five; seven to 11) while the peaks at six and 12 months have their own category. Since in Tajikistan the timing of first order conceptions is very strongly related to the timing of marriage, with a rapid progression from first marriage to first birth, separate models are fitted for first and higher order conceptions (Table 4). There is some evidence for a disruptive effect of spousal separation on fertility for childless women, with all durations of spousal absence showing reduced odds of conception compared to the no-migration reference category. However, these effects are not significant: given the relatively small number of cases in each category, there is a lack of statistical power to test for differences.

Figure 2: Number of months spent abroad by male spouse in years of labour migration



Relates to couple years from 1998-2002 inclusive.
Source: author's analysis of Tajikistan Living Standards Survey (2003).

Table 4: Factors influencing odds of conception in a particular year: odds ratios from single process models for a) first conceptions b) higher order conceptions

N_a	N_b	Y_a	Y_b	**Variable**	**a. first conception**		**b. higher order conceptions**	
				Spousal absence in year (months)				
2161	13280	575	1996	0	1		1	
17	142	3	22	1-5	0.56	0.656	1.04	0.216
20	175	3	31	6	0.36	0.637	0.98	0.248
22	226	3	25	7-11	0.62	0.653	0.70	0.224
15	180	3	7	12	0.76	0.672	0.25**	0.404
				Year				
471	2519	117	417	1998	1		1	
465	2653	146	475	1999	1.44*	0.153	1.16†	0.078
445	2799	114	410	2000	1.11	0.159	0.93	0.079
416	2961	121	457	2001	1.37*	0.160	1.04	0.077
438	3071	87	322	2002	0.78	0.169	0.69**	0.084
				Controls for past childbearing				
				Parity[a]				
	2002		581	1	-		1	
	2800		551	2			0.72**	0.075
	2866		395	3			0.58**	0.089
	2535		251	4			0.51**	0.106
	1628		144	5			0.51**	0.131
	1106		73	6			0.47**	0.163
	1066		86	7+			0.71*	0.168
				Years since union[b]				
604		210		0	1		-	
481		169		1	0.97	0.132		
258		91		2	0.99	0.164		
137		33		3	0.53**	0.229		
98		20		4	0.44**	0.281		
657		64		5+	0.29**	0.201		
				Years since previous birth[c]				
	3001		678	<1	-		1	
	2661		614	1-2			1.13†	0.067
	3122		470	2-4			0.82**	0.072
	2406		215	4-7			0.62**	0.094
	2813		104	7+			0.46**	0.130
				Other individual-level controls				
				Female centred age[d]	0.87**	0.033	0.92**	0.008
				Female centred age squared[d]	0.99**	0.002	1.00**	0.001
				Female highest educational level				

Table 4: (continued)

N_a	N_b	Y_a	Y_b	**Variable**	**a. first conception**		**b. higher order conceptions**	
112	442	33	77	Missing/none/primary	1.01	0.246	1.02	0.140
420	1520	122	261	Secondary basic	0.97	0.135	1.02	0.082
1571	11210	413	1663	Secondary complete	1		1	
132	831	19	80	Higher	0.46*	0.331	0.89	0.131
				Community-level control				
				Region				
503	3083	136	569	Khatlon (rural)	1		1	
87	706	16	117	Khatlon (urban)	0.71	0.313	0.89	0.127
358	2290	107	421	Regions of Republican Subordination (rural)	1.08	0.164	0.95	0.084
47	356	11	58	Regions of Republican Subordination (urban)	0.72	0.378	0.92	0.172
630	3323	169	433	Sogd (rural)	0.85	0.145	0.62**	0.082
151	1200	36	107	Sogd (urban)	0.79	0.225	0.48**	0.126
181	1065	38	143	Gorno-Badakhshan (rural)	1.03	0.232	0.72**	0.116
51	270	11	20	Gorno-Badakhshan (urban)	1.23	0.401	0.39**	0.259
227	1710	63	213	Dushanbe (capital; urban)	1.34	0.200	0.64**	0.100
				Constant (baseline)	-1.09**	0.308	-0.71**	0.126
				σ_u^2	0.013	0.015	0.003	0.003
				σ_v^2	0.009	0.011	0.018†	0.013

†*p*<.10; * *p*<.05; ***p*<.01. Standard error in italics.

N (Y) gives the number of couple years (number of conceptions) in each category for categorical variables: N_a (Y_a) for the model for the first conception; N_b (Y_b) for the model for higher order conceptions. Wald tests for variance parameters are one-tailed. Relates to couple years from 1998-2002 inclusive. Female education and region are fixed within a couple across couple years; all other variables vary by couple year.

a At beginning of the year.

b The difference between the woman's mid-year age and her age at first union (completed years only). Couple years before union are excluded from analysis.

c Time, at the beginning of the year, since the previous birth (includes fractions of a year).

d Mid-year age, in completed years.

Source: author's analysis of Tajikistan Living Standards Survey (2003).

The model for higher order conceptions, benefiting from the pooling of cases across parities, provides a clearer picture[11]. Interestingly, there is no evidence to suggest that periods of absence of up to six months in a given year, characteristic of seasonal migration movements, result in a reduced odds of conception - suggesting that in these instances couples are together long enough to make up for lost reproductive time. For absences of seven to 11 months, there is some evidence for a reduction in conceptions (p=0.11). For absences of 12 months in a given year, there is unambiguous evidence of a disruptive effect (p<0.01). Given that spousal absence was recorded in months only, that there are any conceptions at all in these latter instances may reflect the 'rounding-up' of responses of near-total annual absence when the spouse was in fact present for a period of some weeks. It may also reflect errors introduced by the assumption of a nine-month period of gestation when backdating the date of birth to the date of conception.

A Poisson model was fitted to assess the cumulative impact of periods of spousal absence on the total number of conceptions over the period[12]. Table 5 presents the results. Over the five years considered, there is no evidence that the women whose spouses were away for less than a year in total had fewer conceptions leading to live births than those whose spouses were present for the whole time. However, women whose spouses were away for a total period of between one and two years, or of more than two years, did have significantly fewer births. Of course, given the relatively short span of years analysed - and indeed the short history of labour migration from Tajikistan - it is too early to assess the implications for completed fertility. What is clear is the impact of spousal separation on cumulated fertility thus far; future research should examine whether these couples are able to compensate for these periods of absence in subsequent years.

[11] The results for the control variables are as expected. The regional differences in the odds of a higher order birth are striking: in addition to the capital Dushanbe, the relatively developed Northern region of Sogd, and the geographically isolated and ethnically distinct autonomous region of GBAO, display much lower fertility levels than RRS and Khatlon, the main region of cotton cultivation.

[12] A negative binomial model was also fitted but the ancillary parameter α, an estimate of the degree of overdispersion, was not significant.

Table 5: Factors influencing total number of conceptions leading to live births, 1998-2002: parameter estimates from single process Poisson model

N	Variable		
	Cumulative number of months of spousal separation		
3,111	0	(ref.)	
64	1-5	-0.06	0.146
143	6-11	0.09	0.089
101	12-23	-0.32*	0.127
90	24+	-0.24†	0.133
	Controls		
	Parity[a]		
990	0	(ref.)	
401	1	0.03	0.064
528	2	-0.10	0.070
505	3	-0.19*	0.083
437	4	-0.25*	0.102
284	5	-0.17	0.126
189	6	0.00	0.153
175	7+	0.42*	0.166
	Female centred age[b]	-0.10**	0.006
	Female centred age squared[b]	-0.07**	0.001
	Female highest educational level		
124	Missing/none/primary	0.04	0.100
445	Secondary basic	0.03	0.058
2,737	Secondary complete	(ref.)	
203	Higher	-0.16	0.108
	Region		
769	Khatlon (rural)	(ref.)	
167	Khatlon (urban)	-0.12	0.095
578	Regions of Republican Subordination (rural)	-0.03	0.059
87	Regions of Republican Subordination (urban)	-0.07	0.128
872	Sogd (rural)	-0.32**	0.056
290	Sogd (urban)	-0.53**	0.093
265	Gorno-Badakhshan (rural)	-0.26**	0.085
71	Gorno-Badakhshan (urban)	-0.65**	0.188
410	Dushanbe (capital; urban)	-0.27**	0.073
	Constant (baseline)	0.137	0.073
	σ_v^2	<0.01	0.057

†p<.10; * p<.05; **p<.01. Standard error in italics.
N gives the number of couples in each category for categorical variables (total: 3,509).
a at beginning of 1998.
b age at time of the survey (completed years).
Source: author's analysis of Tajikistan Living Standards Survey (2003).

6.2 Selectivity on observed covariates

Before considering any selectivity associated with 'unobserved' variables which influence both fertility and migration processes, it is interesting to consider how selection based on certain 'observed' characteristics (i.e. three variables which are recorded in the survey: female age, female educational background and region) might influence the relationship between fertility and spousal separation, by comparing estimates from single-process and multi-process[13] models. Table 6 (a) shows the results from a single-process[14] (SP) logistic model for the relationship between conception and spousal absence, omitting these three observed variables. Conditional only on controls for past fertility (parity, and duration since previous birth at the beginning of the calendar year) and calendar year, women married to a spouse who is away for 6-12 months have a 34% lower odds of conception in a given calendar year than those whose spouse is absent for 0-5 months. However, the significance of the random effects at the couple- (p=0.14), and particularly the community- ($p<0.01$), level suggest that there is further variability associated with the effect of couple- and community- level covariates which are not considered in the model. Similarly, the significance of the random effect at the community level ($p<0.01$) for the single-process migration equation, which correspondingly only contains controls for past migration (spousal absence in the previous year) and calendar year, reflects the importance of unobserved heterogeneity.

[13] Here, given the small number of couple years at parity 0 in which spousal separation occurred, only the multiprocess models for higher order conceptions are considered. For simplicity, spousal separation is reduced to a binary variable (absent for 0-5 months/6-12 months), such that the spousal separation equation is a logistic model. Retaining the categories used in the single-process model in Table 4 would have required simultaneously fitting logistic (conception) and ordinal (spousal separation) equations, which cannot be accommodated in MLwiN.

[14] In the single-process model the equation for the conception equation is still fitted jointly with the migration equation, but the random effects across processes are assumed to be uncorrelated (i.e. cov($\sigma^2_{u(y)}$, $\sigma^2_{u(z)}$) and cov($\sigma^2_{v(y)}$, $\sigma^2_{v(z)}$) are both constrained to 0).

Table 6: Single-process (SP) and multiprocess (MP) models [a] predicting odds of higher order conception in a particular year: odds ratio for spousal absence, and random effects parameters

Controls	(a) *(Calendar year, parity[b], years since previous birth[c])*				(b) *(..)*+Female age[d]			
	SP		MP[e]		SP		MP[e]	
Spousal absence in year (months)								
0-5	1		1		1		1	
6-12	0.66**	0.160	0.62**	0.164	0.62**	*0.159*	0.58**	*0.165*
$\sigma^2_{u(y)}$	0.003	*0.003*	0.024**	*0.009*	0.003	*0.003*	0.025**	*0.009*
$\sigma^2_{v(y)}$	0.099**	*0.029*	0.098**	*0.027*	0.073**	*0.026*	0.074**	*0.024*
$\sigma^2_{u(z)}$	0.012	*0.012*	0.120	*0.097*	0.008	*0.010*	0.120†	*0.086*
$\sigma^2_{v(z)}$	0.959**	*0.221*	0.946**	*0.216*	0.972**	*0.222*	0.975**	*0.221*
cov($\sigma^2_{u(y)}$, $\sigma^2_{u(z)}$)	-		0.001	*0.016*	-		-0.001	*0.017*
cov($\sigma^2_{v(y)}$, $\sigma^2_{v(z)}$)	-		0.091†	*0.051*	-		0.078	*0.049*

Controls	(c) *(..)*+Female age[d], female educational background				(d) *(..)*+Female age[d], female educational background, region			
	SP		MP[e]		SP		MP[e]	
Spousal absence in year (months)								
0-5	1		1		1		1	
6-12	0.61**	*0.158*	0.58**	*0.159*	0.61**	*0.157*	0.58**	*0.164*
$\sigma^2_{u(y)}$	0.004	*0.004*	0.024**	0.008	0.003†	*0.002*	0.025**	*0.009*
$\sigma^2_{v(y)}$	0.070**	*0.024*	0.069**	0.023	0.023†	*0.018*	0.027*	*0.014*
$\sigma^2_{u(z)}$	0.014†	*0.009*	0.114†	0.084	0.003	*0.002*	0.101	*0.087*
$\sigma^2_{v(z)}$	0.971**	*0.226*	0.964**	0.222	0.752**	*0.197*	0.733**	*0.192*
cov($\sigma^2_{u(y)}$, $\sigma^2_{u(z)}$)	-		0.000	0.016	-		-0.001	*0.017*
cov($\sigma^2_{v(y)}$, $\sigma^2_{v(z)}$)	-		0.066	0.048	-		0.038	*0.039*

(Notes continued on next page)

(Notes for Table 6)
†*p*<.10; * *p*<.05; ***p*<.01. Standard error in italics.
a Models are based on conception and migration events in 1999-2002, rather than 1998-2002, in order to include in the migration equation a control for spousal absence in the previous calendar year.
b At beginning of the year.
c Time, at the beginning of the year, since the previous birth (includes fractions of a year).
d Mid-year age, in completed years.
e The migration equation in the multiprocess models predicts the log-odds of the male spouse being absent for six months or more in a year. Instead of controls for past childbearing (parity and years since previous birth), there is a control for spousal absence in the previous calendar year. Other individual and community covariates match the fertility equation in the appropriate model. Female education and region are fixed within a couple across couple years; all other variables vary by couple year.
Source: author's analysis of Tajikistan Living Standards Survey (2003).

When these conception and migration equations are fitted together in a multi-process model, there is evidence for a significant positive cross-process covariance of 0.091 (p=0.07), translating into a correlation of 0.30, between the random effects at the community level (Table 6 (a)). The effect of spousal separation is strengthened: women married to a spouse absent for at least six months in a given year have 38% lower odds of conception, compared with 34% in the single-process model. Both the significance of the cross-process correlation, and the difference in the odds ratio for spousal absence between the single- and multi-process models, are indicative of the community-level endogeneity of spousal separation with respect to conception: the presence of community-level variables not included in the model but which affect the odds of each event, such that couples in which the spouse is absent are selected for high fertility. Without taking this endogeneity into account, the coefficient for the effect of spousal separation is biased downwards and the disruptive effect is underestimated.

The direction of this selectivity is as might be expected. In Tajikistan, couples with a lower educational background are more likely to experience spousal separation in a given year; women whose spouses are absent in a given year are on average slightly younger than those whose spouses are present; and the Regions of Republican Subordination (RRS) experience a higher propensity for extended spousal absence than other regions (Section 3). Given also that younger and less well educated women tend to have high fertility, and that RRS is with Khatlon the region with the highest fertility in Tajikistan (Tables 4 and 5), we might indeed expect a positive correlation between the random intercepts for the conception and spousal separation equations when these covariates are not controlled for in the model. Interestingly, however, there is no evidence for selectivity at the couple-level (Table 6 (a)). In part, with only four years of migration and conception information, this might reflect a lack of power to test for the importance of couple-level heterogeneity in conception and migration processes, and hence a lack of power to examine correlations between these random effects. It also suggests that, to the extent to which selection on female age and female education is important in explaining the residual correlation between the conception and migration processes, this selection is operating at the community-level, reflecting differences in the average age and educational level of different communities.

6.3 Unobserved selectivity and contextual influence of community migration patterns

The next step is to examine whether, once these observed covariates are controlled for in both equations in the multi-process model, there is still evidence for endogeneity. If the positive covariance between random effects at the community level remains, this might be interpreted as reflecting either the importance of unobserved community-level factors affecting fertility and migration processes, or the contextual influence of community migration patterns on the odds of conception, rather than selection on the observed covariates.

There is still a positive cross-process covariance (0.078) (p=0.11), representing a correlation of 0.29, between the random effects at the community level when female age is controlled for in both the conception and migration equations (Table 6 (b)). The difference between the single-process and multi-process estimates for the effect of spousal separation is, again, consistent with community-level selectivity. When female educational background is also controlled for, the direction of the cross-process covariance remains positive (0.066, representing a correlation of 0.26) (p=0.17) and there is still a difference between the single-process and multi-process estimates for spousal separation (Table 6 (c)). It is noticeable that, after controlling for female age and educational background, the significance of the community level cross-process covariance weakens. Thus, to a small extent, the positive community-level residual correlation between the migration and fertility processes may reflect differences in the age and educational profile of communities - such that communities with a high propensity for spousal absence are on average younger and less highly educated, characteristics associated with high fertility. However, selection on these observed covariates only accounts for a fraction of the community-level cross-process covariance.

In terms of the contextual influence of community migration patterns, there is certainly no evidence for the diffusion of assimilated cultural values relating to fertility – which would have predicted a negative community-level relationship between international migration and fertility. The direction of the cross-process relationship is consistent with the results of Lindstrom and Giorguli Saucedo (2002) and Agadjanian et al. (2008), where a contextual community-level variable indicating the prevalence of male migration was significantly positively correlated with the odds of conception in a given year, after controlling for direct separation effects. Both of these studies suggest that the economic benefits of migration may serve to strengthen family systems within the community. However, the migration context in Tajikistan is very different to Mexico and Mozambique respectively. By the beginning of 2003, the end of the period analysed with the survey data, Tajik communities may have experienced international labour migration for a maximum of eight or nine years – compared to the communities in Mexico which have experienced labour migration for generations. It is unclear whether, over such a short period, the possible strengthening community-level role of migration would have had time to take effect.

In the Tajik case, therefore, the remaining cross-process covariance between migration and fertility at the community level may be more likely simply to reflect selection on ‘unobserved’ characteristics associated with fertility, rather than the contextual influence of community migration patterns. It is possible, for example, that both migration and high fertility would be more prevalent in communities in the more remote mountainous areas; indeed, Olimova (2005) notes the connection between altitude and migration behaviour in Tajikistan. More generally, given that labour migration in Tajikistan is prompted by economic need, poorer communities – in which women tend to have higher than average fertility - may display an above average prevalence of labour migration. These unobserved variables partly vary on a regional basis: when region is also controlled for in both the migration and fertility equations, the significance of the cross-process covariance weakens further (p=0.33) (Table 6 (d)). Nevertheless, even in this final setup, where all possible observed covariates are controlled for (the coefficients are displayed in full in Table 7) - the difference between the estimates for the single-process and multi-process models suggests that the disruptive influence of spousal separation is underestimated in a single-process model which does not account for the endogeneity of spousal separation with respect to fertility.

Table 7: Factors influencing odds of conception in a particular year: odds ratios from single- and multiprocess models[a] for higher-order conceptions

N	Y	**Variable**	SP		MP[b]	
		Spousal absence in year (months)				
10,954	1,612	0-5	1		1	
530	52	6-12	0.61**	0.157	0.58**	0.164
		Year				
2,653	475	1999	1		1	
2,799	410	2000	0.80**	0.078	0.80**	0.078
2,961	457	2001	0.90	0.076	0.90	0.076
3,071	322	2002	0.60**	0.083	0.60**	0.083

Table 7: (Continued)

N	Y	**Variable**	SP		MP[b]	
		Controls for past childbearing				
		Parity[c]				
1,601	461	1	1			
2,272	440	2	0.71**	0.084	0.71**	0.085
2,361	319	3	0.57**	0.099	0.57**	0.100
2,098	205	4	0.51**	0.118	0.51**	0.118
1,344	110	5	0.48**	0.147	0.48**	0.146
917	61	6	0.51**	0.180	0.50**	0.181
891	68	7+	0.70†	0.191	0.70†	0.189
		Years since previous birth[d]				
2,419	545	<1	1		1	
2,190	490	1-2	1.10	0.075	1.10	0.074
2,471	367	2-4	0.84*	0.082	0.85*	0.082
1,973	175	4-7	0.62**	0.105	0.62**	0.105
2,431	87	7+	0.45**	0.145	0.46**	0.144
		Other individual-level controls				
		Female centred age[e]	0.92**	0.008	0.92**	0.008
		Female centred age squared[e]	1.00**	0.001	1.00**	0.001
		Female highest educational level				
369	68	Missing/none/primary	1.12	0.151	1.12	0.153
1,272	215	Secondary basic	0.99	0.090	0.99	0.091
9,167	1,319	Secondary complete	1		1	
676	62	Higher	0.88	0.149	0.88	0.150
		Community-level control				
		Region				
2,533	458	Khatlon (rural)	1		1	
576	94	Khatlon (urban)	0.92	0.142	0.92	0.145
1,884	343	Regions of Republican Subordination (rural)	0.98	0.093	0.98	0.095
293	48	Regions of Republican Subordination (urban)	0.97	0.192	0.98	0.195
2,734	345	Sogd (rural)	0.62**	0.090	0.62**	0.092
974	85	Sogd (urban)	0.49**	0.142	0.49**	0.143
873	105	Gorno-Badakhshan (rural)	0.65**	0.132	0.65**	0.134
221	16	Gorno-Badakhshan (urban)	0.40**	0.290	0.40**	0.293
1,396	170	Dushanbe (capital; urban)	0.65**	0.112	0.65**	0.113
		Constant (baseline)	-0.553	0.137	-0.566	0.135
		$\sigma^2_{u(y)}$	0.003†	0.002	0.025**	0.009
		$\sigma^2_{v(y)}$	0.023†	0.018	0.027*	0.014
		$\sigma^2_{u(z)}$	0.003	0.002	0.101	0.087
		$\sigma^2_{v(z)}$	0.752**	0.197	0.733**	0.192
		cov($\sigma^2_{u(y)}$, $\sigma^2_{u(z)}$)	-		-0.001	0.017
		cov($\sigma^2_{v(y)}$, $\sigma^2_{v(z)}$)	-		0.038	0.039

(Notes for Table 7)

†p<.10; * p<.05; **p<.01. Standard error in italics.

N [Y] gives the number of couple years (total: 11,484) [number of conceptions (total:1,664)] in each category for categorical variables. Wald tests for variance parameters are one-tailed.

a Models are based on conception and migration events in 1999-2002, rather than 1998-2002, in order to include in the migration equation a control for spousal absence in the previous calendar year.

b The migration equation in the multiprocess model predicts the log-odds of the male spouse being absent for six months or more in a year. Instead of controls for past childbearing, there is a control for spousal absence in the previous calendar year. Other individual and community covariates match the fertility equation in the appropriate model. Because the research focus is on fertility, the covariate coefficients for the migration equation are not presented. Female education and region are fixed within a couple across couple years; all other variables vary by couple year.

c At beginning of the year.

d Time, at the beginning of the year, since the previous birth (includes fractions of a year).

e Mid-year age, in completed years.

Source: author's analysis of Tajikistan Living Standards Survey (2003).

7. Discussion and directions for future research

This paper adds to the very small number of studies examining the impact of temporary migration on fertility in origin areas using individual-level data. While past studies have tended to be based on data collected from a particular region within a country, this paper is able to make use of a nationally representative survey which had collected both birth and migration histories. Following Massey and Mullan (1984), Lindstrom and Giorguli Saucedo (2002; 2007) and Agadjanian et al. (2008), it helps to illustrate the clear short-term disruptive influence of temporary migration and spousal separation on fertility. It finds no evidence for selectivity at the couple level after controlling for common covariates. However, it does find evidence for a positive correlation between the migration and fertility processes at the community level. This only partly reflects selection on female age and female educational background; the remaining covariance is likely to reflect the influence of 'unobserved' variables affecting both processes. Accounting for this covariance leads to an unbiased estimate of the effect of spousal separation on fertility, exemplifying the utility of a multi-process approach.

The research does have its limitations. For example, it does not accommodate possible reverse causation – the possibility that the migration of the spouse may be postponed by childbearing, or prompted by it if it intensifies financial need. A fully structural model, allowing for the effect of conception in a given year on spousal absence as well as vice versa, would require instruments related to one of the processes and not the other (Steele 2005). A further limitation is that the analysis is restricted to couples in union. Therefore, while the direct effect of male labour migration on marital fertility is considered, the possible impact on marriage itself is not. Harris (1998) reports, of the Garmi villages in Khatlon, that 'the absence of young men of marriageable age has made it extremely difficult to find spouses for the girls and there are increasing numbers of unmarried girls aged 22 or 23 [which was previously unheard of]'. Future quantitative research on the gender imbalance-marriage link would provide further insights into how childbearing has been affected by male labour migration.

Since international labour migration from Tajikistan is a relatively recent phenomenon, its impact on completed fertility levels is not yet clear. Lindstrom and Giorguli Saucedo (2002; 2007) show that Mexican couples are able to make up for lost reproductive time following the periods of separation. In Tajikistan, we might expect the effect of separation on cumulated fertility evident in Table 5 to weaken as time progresses, allowing for periods of recuperation as spouses return after spells abroad. However, much depends on the future pattern of labour migration. In Mexico couples have been able to compensate for absence because the periods are relatively short in duration and repeated long separations are unusual. The long-term impact on fertility in Tajikistan may also be limited if seasonal migration comes to dominate international labour movements. However, Mughal (2007:84), examining statistics from the Russian border service, notes the increasing annual number of 'non-returnees' to Tajikistan, hinting at the consolidation of a trend towards longer-term stays and more permanent settlement in the last few years – which would be more likely to affect completed fertility levels. It will also be interesting to monitor the gender composition of labour migrants in future years. If women start to migrate in large numbers as well as men, the assimilation and diffusion of adopted cultural values relating to fertility behaviour may be expected to exert a downward influence on fertility to add to any longer-term impacts of disruption.

More generally, more research is needed on the relationship between migration and fertility in the post-socialist context. In both Central Asia and Eastern Europe, there have been striking changes in marital and fertility behaviour since the beginning of the 1990s, and new and significant international labour movements have emerged. Future work examining the links between these trends would be most welcome.

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References

Agadjanian, V., Yabiku, S., and Cau, B. (2008). *Men's migration and women's fertility in rural Mozambique*. Paper presented at the annual meeting of the Population Association of America, New Orleans, April 17-April 19 2008.

Anderson, B.A. and Silver, B.D. (1989). Demographic sources of the changing ethnic composition of the Soviet Union. *Population and Development Review* 15(4): 609-656. doi:10.2307/1972593.

Anichkin, A.B. and Vishnevskii, A.G. (1992). 3 types of birthrates in the USSR - stages of demographic transition. *Matekon* 28(4): 61-74.

Becker, G.S. (1991). *A Treatise on the Family*. Cambridge, Mass.; London: Harvard University Press.

Bongaarts, J. and Potter, R.G. (1979). Fertility effect of seasonal migration and seasonal variation in fecundability: Test of a useful approximation under more general conditions. *Demography* 16(3): 475-479. doi:10.2307/2061226.

Boyle, P.J., Kulu, H., Cooke, T., Gayle, V., and Mulder, C.H. (2008). Moving and Union Dissolution. *Demography* 45(1): 209-222. doi:10.1353/dem.2008.0000.

Browne, W.J. (2002). MCMC estimation in MLwiN. London: Institute of Education, University of London.

Casterline, J., Perez, A., and Biddlecom, A. (1997). Factors underlying unmet need for family planning in the Philippines. *Studies in Family Planning* 28(3): 173-191. doi:10.2307/2137886.

Chattopadhyay, A., White, M.J., and Debpuur, C. (2006). Migrant fertility in Ghana: Selection versus adaptation and disruption as causal mechanisms. *Population Studies* 60(2): 189-203. doi:10.1080/00324720600646287.

Chen, L.C., Ahmed, S., Gesche, M., and Mosley, W. (1974). A prospective study of birth interval dynamics in rural Bangladesh. *Population Studies* 28(2): 277-279. doi:10.2307/2173959.

Falkingham, J. (2000). *Women and Gender Relations in Tajikistan*. Manila: Asian Development Bank.

Foroughi, P. (2002). Tajikistan: nationalism, ethnicity, conflict and socio-economic disparities - sources and solutions. *Journal of Muslim Minority Affairs* 22(1): 39-61. doi:10.1080/13602000220124827.

Gabrielli, G., Paterno, A., and White, M. (2007). The impact of origin region and internal migration on Italian fertility. *Demographic Research* 17(24): 705-740. doi:10.4054/DemRes.2007.17.24.

Goldstein, H. (2003). *Multilevel Statistical Methods*. London: Arnold.

Harris, C. (1998). Coping with daily life in post-Soviet Tajikistan: the Gharmi villages of Khatlon province. *Central Asian Survey* 17(4): 655-672. doi:10.1080/02634939808401062.

Harris, C. (2002). Muslim views on population: The case of Tajikistan. In: Meuleman, J. (ed.). *Islam in the Era of Globalization: Muslim Attitudes Towards Modernity and Identity*. London: Routledge**:** 211-225.

Hoem, J.M. and Kreyenfeld, M. (2006a). Anticipatory analysis and its alternatives in life-course research. Part 1: Education and first childbearing. *Demographic Research* 15(16): 461-484. doi:10.4054/DemRes.2006.15.16.

Hoem, J.M. and Kreyenfeld, M. (2006b). Anticipatory analysis and its alternatives in life-course research. Part 2: Marriage and first birth. *Demographic Research* 15(17): 485-498. doi:10.4054/DemRes.2006.15.17.

Kulu, H. (2005). Migration and Fertility: Competing Hypotheses Re-examined. *European Journal of Population* 21(1): 51-87. doi:10.1007/s10680-005-3581-8.

Kulu, H. and Milewski, N. (2007). Family change and migration in the life course: An introduction. *Demographic Research* 17(19): 567-590. doi:10.4054/DemRes.2007.17.19.

Leone, T. and Hinde, A. (2007). Fertility and union dissolution in Brazil: An example of multi-process modelling using the Demographic and Health Survey calendar data. *Demographic Research* 17(7): 157-180. doi:10.4054/DemRes.2007.17.7.

Lindstrom, D.P. and Giorguli Saucedo, S. (2002). Short-and Long-Term Effects of US Migration Experience on Mexican Women's Fertility. *Social Forces* 80(4): 1341-1368. doi:10.1353/sof.2002.0030.

Lindstrom, D.P. and Giorguli Saucedo, S. (2007). The interrelationship between fertility, family maintenance, and Mexico-US migration. *Demographic Research* 17(28): 821-858. doi:10.4054/DemRes.2007.17.28.

Lynch, D. (2002). Separatist states and post-Soviet conflicts. *International Affairs* 78(4): 831-848. doi:10.1111/1468-2346.00282.

Mason, K. and Smith, H. (2000). Husbands'versus wives' fertility goals and use of contraception: the influence of gender context in five Asian countries. *Demography* 37(3): 299-311. doi:10.2307/2648043.

Massey, D.S. and Mullan, B.P. (1984). A demonstration of the effect of seasonal migration on fertility. *Demography* 21(4): 501-517. doi:10.2307/2060912.

Menken, J. (1979). Seasonal Migration and Seasonal Variation in Fecundability: Effects on Birth Rates and Birth Intervals. *Demography* 16(1): 103-119. doi:10.2307/2061082.

Milewski, N. (2007). First child of immigrant workers and their descendants in West Germany: interrelation of events, disruption, or adaptation? *Demographic Research* 17(29): 859-896. doi:10.4054/DemRes.2007.17.29.

Millman, S.R. and Potter, R.G. (1984). The fertility impact of spousal separation. *Studies in Family Planning* 15(3): 121-126. doi:10.2307/1965462.

Mughal, A.-G. (2007). Migration, Remittances and Living Standards in Tajikistan: A Report Based on Khatlon Remittances and Living Standards Measurement Survey (KLSS 2005). Dushanbe: International Organisation for Migration (IOM).

Nedoluzhko, L. and Andersson, G. (2007). Migration and first-time parenthood: Evidence from Kyrgyzstan. *Demographic Research* 17(25): 741-774. doi:10.4054/DemRes.2007.17.25.

Olimova, S. (2005). *Impact of External Migration on Development of Mountainous Regions*. International Workshop on Strategies for Development and Food Security in Mountainous Areas of Central Asia, Dushanbe, 6-10 June 2005.

Olimova, S. and Bosc, I. (2003). *Labour Migration from Tajikistan*. Dushanbe: International Organisation for Migration.

Rasbash, J., Steele, F., Browne, W., and Prosser, B. (2004). *A user's guide to MLwiN version 2.0*. London: Institute of Education.

Ratha, D., Mohapatra, S., and Xu, Z. (2008). Migration and Development Brief. Outlook for Remittance Flows 2008-2010. Report No. 46715. Migration and Remittances Team, Development Prospects Group, The World Bank.

Razzaque, A. (1999). Preference for children and subsequent fertility in Matlab: does wife-husband agreement matter? *Journal of Biosocial Science* 31(1): 17-28. doi:10.1017/S0021932099000176.

Rowland, R.H. (2005). National and regional population trends in Tajikistan: Results from the recent census. *Eurasian Geography and Economics* 46(3): 202-23. doi:10.2747/1538-7216.46.3.202.

Singley, S.G. and Landale, N.S. (1997). Incorporating Origin and Process in Migration-Fertility Frameworks: The Case of Puerto Rican Women. *Social Forces* 76: 1437-1464. doi:10.2307/3005841.

Steele, F. (2005). A Multiprocess Model for Correlated Event Histories with Multiple States, Competing Risks, and Structural Effects of One Hazard on Another [electronic resource]. Centre for Multilevel Modelling: http://www.cmm.bristol.ac.uk/research/Multiprocess/mmcehmscrseoha.pdf.

Steele, F., Goldstein, H., and Browne, W. (2004). A general multilevel multistate competing risks model for event history data, with an application to a study of contraceptive use dynamics. *Statistical Modelling* 4(2): 145-159. doi:10.1191/1471082X04st069oa.

Steele, F., Kallis, C., Goldstein, H., and Joshi, H. (2005). The relationship between childbearing and transitions from marriage and cohabitation in Britain. *Demography* 42(4): 647-673. doi:10.1353/dem.2005.0038.

TransMONEE (2006). *TransMONEE 2006 Database*. Florence: Unicef Innocenti Research Centre.

Turner, R. (1993). Tajiks have the highest fertility rates in newly independent Central Asia. *Family Planning Perspectives* 25(3): 141-2. doi:10.2307/2136166.

van de Walle, F. (1975). Migration and fertility in Ticino. *Population Studies* 29(3): 447-462. doi:10.2307/2173938.

White, M.J., Moreno, L., and Guo, S. (1995). The interrelation of fertility and geographic mobility in Peru: a hazards model analysis. *International Migration Review* 29(2): 492-514. doi:10.2307/2546791.