Rural-to-Urban Migration and Fertility in an Environment of Change: Evidence from Nang Rong, Thailand.

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Introduction

The social, economic, and demographic consequences of the sharp increases in population mobility that have come to characterize the contemporary development process are a persistent theme in both sociological and demographic research. While migration has been linked to a variety of behavioral outcomes(e.g. Goldstein and Goldstein 1981; Landale and Hauan 1996; Singley and Landale 1998; Stephen and Bean 1992), its relationship with fertility has attracted particular attention within demography. Research in this area has found significant effects of both international and internal migration on the fertility behavior of migrants (e.g. Goldstein, White and Goldstein 1997; Lindstrom and Saucedo 2002; Massey and Mullan 1984; Yang 2000), while a number of general theories of fertility change attribute a significant role to migration, particularly in terms of the diffusion of norms and practices from urban to rural areas (e.g. Bongaarts and Watkins 1996; Montgomery and Casterline 1996). However, researchers have only recently begun to focus on how this relationship is influenced by both the permanence and frequency of migration movements over the life course of individuals. The majority of research in this area has focused on longer-term migration, despite the prevalence of short-term migration in many parts of the world (Lindstrom and Saucedo 2002) and the implications this has for theories explaining how migration influences fertility behavior. In addition, much of this research is limited in its ability to fully examine the role of origin context and migrant selectivity in shaping this relationship, leaving a number of questions about the validity of the conclusions they reach regarding the effect of migration.

This study draws on a unique longitudinal dataset to explore the ways in which rural-to-urban migration influences the fertility behavior of women from 22 villages in Nang Rong, a predominantly rural district in the Northeast province of Thailand. Nang Rong is an interesting setting in which to explore this topic, having experienced a series of dramatic social, economic, and demographic changes over the past three decades. In particular, this period has been marked by precipitous decline in fertility and sharp increases in migration to urban areas, mirroring broader changes throughout rural Thailand. The specific focus of this study is on the ways in which the relationship between migration and fertility differs depending on both the permanence and frequency of migration. I also explore how this is influenced by migrant selectivity and explore of the role of the potential endogeneity of the fertility and migration processes, leading to a more complete understanding of the interrelationships between these two processes. The data used include both detailed retrospective life history information for migrants and non-migrants and baseline information on their household and village characteristics in 1984, 1994, and 2000, allowing for a study design that is explicitly prospective in nature. This makes possible a research approach that is both consistent with the temporal expectations implicit in existing theories linking migration to fertility behavior and that is able to take into account the role of both migration experience over the life course and migrant selectivity in shaping fertility behavior.

The results of the analysis indicate that fertility behavior does differ between the different types of migration flows, but that this relationship differs according to family formation stage. While urban experience over the life course has a dampening effect on fertility, current migrant status is only an important determinant of fertility among lower parity women, implying that other factors associated with the migration process, including migrant selectivity and the role of migration in facilitating marriage may play an important role in this relationship. This suggests that in this context migration plays an important role in the process of family formation by encouraging entry into marriage, which in turn encourages earlier fertility.

Theoretical Perspectives on Migration and Fertility

The effect of migration experience on reproductive behavior is generally hypothesized to result from one or more of three processes – assimilation, adaptation, and disruption (Hervitz 1985; Lindstrom and Saucedo 2002; Singley and Landale 1998), in addition to migrant selectivity. The *assimilation* hypothesis argues that migrants slowly adopt the norms and values governing family formation and fertility behavior in the destination society (Stephen and Bean 1992). This process is gradual, with migrants continuing to be strongly influenced by the norms and values learned during socialization, and may take a number of generations to complete (Lindstrom and Saucedo 2002). The *adaptation* hypothesis argues that migrants deliberately alter their behavior in an attempt to adjust to the destination environment and fully take advantage of the returns to migration, resulting in relatively rapid changes in fertility behavior. However, this change may not reflect long-terms shifts in fertility preferences, as is argued by the assimilation hypothesis (Lindstrom and Saucedo 2002; Rumbaut and Weeks 1986). The *disruption* hypothesis focuses on how the migration experience itself interrupts normal fertility behavior. This is usually assumed to lead to a comparatively short-term change in behavior resulting from either spousal separation or the uncertainty associated with the move to a new social and economic environment (Hervitz 1985; Menken 1979; Singley and Landale 1998). A further explanation for the differences in the fertility patterns of migrants that features prominently in the literature is that of *selectivity*. The assimilation, adaptation, and disruption hypotheses all predict changes in fertility behavior as a direct result of the migration experience itself. In contrast, the selectivity hypothesis argues that differences in the observed fertility patterns of migrants and non-migrants result from the ways in which the process of migration selects individuals on a number of social, demographic, or psychological characteristics that are associated with higher or lower levels of fertility (Hervitz 1985; Lindstrom and Saucedo 2002; Ribe and Schultz 1980; Singley and Landale 1998).

The literature on migration and fertility offers mixed empirical support for each of these hypotheses. While the assimilation approach has found support primarily in studies of international migrant groups (e.g. Stephen and Bean 1992), there is relatively little research exploring this approach in terms of internal migration (one example is Hervitz 1985, who finds limited support for assimilation effects in Brazil). In contrast, there is considerable support for the adaptation hypothesis in the literature on internal migration, although the effect of this process on completed fertility remains unclear (for a review of this literature, and that supporting the assimilation and selectivity hypotheses, see Kulu 2005). The effect of disruption on fertility has been demonstrated in a number of settings, although the implications of this for completed fertility is again unclear (e.g. Goldstein and Goldstein 1983; Lindstrom and Saucedo 2002; Massey and Mullan 1984; Stephen and Bean 1992; White, Moreno and Guo 1995). While there is considerable discussion of the role of selectivity in leading to the observed differences in fertility between migrants and non-migrants (e.g. Goldstein and Goldstein 1981), relatively few studies have had the appropriate information on non-migrants in the origin communities to examine its effects on the migration estimates. The research that has been able to explore these issues has found evidence that migrants are selected on a variety of criteria, although the impact of this on the estimated effect of migration on fertility is not well established (e.g. Lindstrom and Saucedo 2002; Singley and Landale 1998; White et al. 1995).

The overwhelming majority of this research has been conducted in settings where migrants face a significantly different fertility environment in the destination than in their home communities, meaning that relatively little is known about how fertility is influenced by the migration experience when differences in fertility levels between origin and destination are relatively small, as is the case for this study. In these contexts the influence of both the processes of assimilation and adaptation are likely to be relatively small, potentially influencing the timing and spacing of fertility, rather than completed fertility. This implies that the disruption and selectivity hypotheses are likely to have the greatest effect on fertility behavior in these contexts, although their effect on completed fertility is may also be limited.

A number of recent studies have suggested that while these hypotheses provide important insights into the ways in which migration affects fertility, a more complete understanding of the processes involved must include a more comprehensive assessment of the role of migration within the framework of the life course, particularly with regard to the process of family formation. Within this framework, the relationship between migration and fertility is dependent on life course and family formation stage, with the effect of migration on fertility differing in response to both. Singley and Landale (1998) find that the likelihood of single women migrants from Puerto Rico to the United States forming a union or experiencing a conception either inside or outside of marriage was greater than that of non-migrants, despite the overall lower fertility associated with residence in the United States. The authors attribute this to differences between the United States and Puerto Rico in terms of patterns of union formation. Andersson (2001) reaches a similar conclusion for immigrants to Sweden, arguing that migration acts as a trigger for fertility among many immigrant groups, partly because a significant portion of the immigration is tied to marriage. As Singley and Landale (1998) point out, this in part reflects an element of selectivity among migrants, as part of the effect of migration on fertility is a reflection of the dynamics of the beginning of the family formation process, which is a life course stage that is selective of particular individuals. In the case of Thailand, migration is often the result of union formation and births typically follow marriage closely (Limanonda 1992). Recent research examining rural-to-urban migration in Thailand suggests that for many women migration is closely tied to the process of family formation, with migration encouraging marriage through both exposing the migrant to a broader marriage market and through improving their economic standing (Jampaklay 2003). This suggests that the observed relationship between migration and fertility in this context will be at least partly a reflection of the ways in which migration is related to the family formation process.

A further implication of this approach is that fertility and migration behavior at any given point, and the relationship between these, is assumed to reflect both accumulated experiences and current influences on behavior. In terms of the relationship between migration and fertility, this means that past fertility and migration behavior must be taken into account. While most research in this area does attempt to account for past fertility behavior through including current parity or the time since last birth (or marriage in the case of childless women), relatively few studies have been able to account for accumulated migration experience, with most focusing on current migration status. As a result, the literature in this area has done a relatively poor job of assessing the impact of total lifetime migrant experience on fertility behavior.

Incorporating a life course framework into the exploration of the relationship between migration and fertility has a number of implications for each of the hypotheses described above. In particular, their ability to explain this relationship is likely to vary over the life course, suggesting that at least some of the effect of migration on fertility is explained by factors that these hypotheses do not take into account. This is particularly clear when considering the ways in which both fertility and migration may be influenced by the family formation process, which itself is highly dependent on life course factors. While the linkages between fertility and the process of family formation are relatively clear, this may also influence migration behavior, particularly in situations where migration is closely tied to marriage. While this may influence the degree to which each of these hypotheses are able to explain the relationship between migration and fertility, the effect of this is clearest for the disruption hypothesis, as migration may represent the beginning of a period of greater exposure to the risk of a birth, the opposite of the effect posited by this hypothesis. The emphasis of the life course approach on both accumulated experiences and current context also has a number of implications for these hypotheses. In particular, both the processes of assimilation and adaptation are likely to be influenced by accumulated migration and, to a lesser degree, fertility experience. This is particularly true for assimilation, as this process assumes that greater exposure to a different environment leads to gradual changes in preferences and attitudes, including those related to fertility. As a result, prior migration experience may influence the degree to which behavior is shaped by current migration status, implying that failing to take both into account may lead to misleading results when considering current migration status only.

While prior research provides a number of insights into the ways in which migration influences fertility behavior, most of these studies have relied on either cross-sectional information on migrants (Bach 1982; Goldstein 1973; Hervitz 1985), or on retrospective life history information collected in the destination location (e.g. Goldstein et al. 1997; Lindstrom and Saucedo 2002). The use of these types of data to examine the relationship between migration and fertility is problematic for a number of reasons. First, with the exception of explanations based on migrant selectivity, each of the hypotheses described above implicitly involves assumptions regarding changes in individual preferences and/or behavior over time (Singley and Landale 1998). As a result, a complete examination of the effect of migration on fertility requires longitudinal information on a number of individual level characteristics, as well as information on the characteristics of the origin locations prior to both migration and fertility. In addition, each of these approaches assumes a clear temporal order where fertility decisions take place after migration, reinforcing the need for longitudinal data on the timing of both migration and fertility.

Second, the use of data collected only from migrants in the destination location prevents an accurate comparison of the fertility behavior of migrants with an appropriate reference group of non-migrants from their origin community. Consequently, the changes in fertility that are specifically associated with migration are confounded with the effects of residing in the destination location (Bach 1982; Singley and Landale 1998). While recent research attempts to remedy this through the inclusion of information on individuals in the origin communities in their analyses of migration and fertility (Lindstrom and Saucedo 2002; Singley and Landale 1998), the designs of most of these studies are purely retrospective, with data being collected after both fertility and migration have taken place. As a result, the reference group in the origin location may not be fully representative of the population the migrants originally came from, due to unmeasured attrition through death or migration. This prevents a complete evaluation of the role selectivity plays in the fertility behavior of migrants, as comparisons between their behavior and that of non-migrants in their origin communities are problematic. This is also true for return migration, although this is selective on both origin and destination factors.

Third, because these studies are unable to include information on the characteristics of migrant's households and communities prior to migration, they are unable to directly estimate the effect of origin context on migrant behavior. Previous research has emphasized the importance of past context, particularly that within which socialization took place, for a number of behavioral outcomes related to fertility (Axinn, Clarkberg and Thornton 1994; Axinn and Yabiku 2001; Brewster, Billy and Grady 1993; Degraff, Bilsborrow and Guilkey 1997; Entwisle et al. 1996; Freedman 1997). This is particularly important for the assessment of the ways in which the assimilation process shapes fertility behavior, as it implies that the influence of past context on current behavior will diminish as migrants spend more time in the destination location. In addition, the lack of information on pre-migration contextual characteristics makes it impossible to assess the effect of changes in the origin community on the fertility behavior of both migrants and non-migrants. This is particularly problematic in contexts of rapid change, as is the case for many countries going through the process of development.

Fourth, relatively few of these studies have explicitly acknowledged the ways in which the processes of fertility and migration may be endogenous with respect to each other, with each potentially depending on the other. While the literature in this area has focused on the effect of migration on fertility, past fertility may also be an important determinant of migration. As a result, the estimates produced by empirical analyses may be biased, potentially resulting in misleading conclusions on the importance of migration for fertility behavior. This is particularly a problem for research relying on cross-sectional study designs, as it is typically impossible to accurately establish the temporal ordering of migration and other family formation events. This is less of an issue when longitudinal data is available and suitable lags can be introduced into the model to take into account the temporal order implied by these hypotheses and clearly distinguish the causal relationship between the two processes.

Finally, research in this area has been focused almost exclusively on long-term permanent migration, ignoring the role that shorter-term repeated migration may play in shaping fertility behavior. In focusing on this type of migration, I hope to better understand the myriad of ways in which migration may influence fertility behavior. This is particularly important given the prevalence of this type of migration, and its importance to the process of economic and social development. In the following section, I describe the ways in which temporary migration is theorized to influence fertility behavior, and the implications this has for existing explanations of this relationship.

Temporary Migration and Fertility

The hypotheses described above are based predominantly on a conceptualization of migration as a process involving a single move followed by an extended or permanent period of exposure to the social and cultural environment of the destination location. However, the implications of migration patterns involving repeated movement between origin and location for these hypotheses remain somewhat ambiguous, and relatively unexplored in the literature. The few studies that have incorporated these patterns of migration have focused primarily on the disruptive effects of migration on fertility (Lindstrom and Saucedo 2002). Menken (1979) demonstrated mathematically the potential importance of recurrent spousal separation on fertility, while both Massey and Mullen (1984) and Lindstrom and Saucedo (2002) find that repeated migration reduces birth probabilities in the short-term. However, these studies have focused primarily on circular movements covering a considerable period of time and typically involving traveling significant distances, both of which amplify the disruptive effect of migration on fertility. Neither is necessarily true in the case of Nang Rong, where significant portions of migration movements are seasonal, and migration destinations are relatively accessible.

Shorter-term migration also has a number of implications for the ways in which the processes of migrant assimilation, adaptation, and selectivity shape fertility behavior. Individuals entering the migration process with the intention to return to their origin village have much less incentive to change their behavior than migrants whose intention is to settle in the destination location permanently. As a result, the effect of exposure to the norms and values of the destination society on long-term fertility behavior is likely to be less important for these individuals. On the other hand, because they are aware that their stay in the destination is temporary, these migrants may be more prepared to adapt their behavior in order to fully take advantage of the economic and social opportunities provided by the destination location. If migrants adopt a pattern of circular short-term migration, this may influence the ways migrants respond to the disruptive effects of migration. While some degree of disruption is clearly an inherent part of each move, repeat migrants may be better equipped to deal with this as the result of prior experience and previously established networks that facilitate the migration process. However, the cumulative effect of repeated migration events over a migrant's reproductive life, and the disruption this entails, may result in lower completed fertility than would be the case for permanent migrants.

Selectivity issues may also influence the relationship between temporary migration and fertility, particularly if it involves a pattern of repeated migration. However, these are somewhat more complex than is the case for permanent migration, as each stage of the process is subject to potential selectivity. In addition to selectivity in the initial migration movement, those migrants who choose to return to the origin village may also be selected on a number of criteria. The same logic applies to subsequent migration decisions, suggesting that this group of migrants may not be a representative subsample of the migrant population. Prior research examining the determinants of return migration provides mixed evidence of the effect of selection processes, although acknowledging their potential importance (Borjas and Bratsberg 1996; Lindstrom 1996; Lindstrom and Saucedo 2002; Reagan and Olsen 2000).

Previous research in Thailand has found evidence supporting each of the four main hypotheses explaining the effect of migration on fertility, although most of this research took place when fertility in rural Thailand differed substantially from that in urban areas, and is therefore of limited assistance to this paper. A number of studies examining the fertility behavior of urban migrants have found support for the assimilation and adaptation hypotheses, with longer-term migrants conforming closely to the fertility patterns in the destination location, despite relatively large differences between the fertility patterns of their origin communities and the urban areas to which they had migrated (Goldstein 1973; Goldstein and Goldstein 1981). In addition, some support was also found for the disruption hypothesis, with the fertility of relatively recent migrants being considerably lower than that of either migrants or non-migrants in the destination location (Goldstein 1973). While these studies suggest a number of interesting differences between temporary and permanent migration in Thailand, they are limited in their ability to accurately compare migrants and non-migrants over time by their reliance on data collected from migrants in their destination locations at single points in time. In addition, the relevance of these findings to the contemporary social and demographic situation in Thailand is likely to be limited, particularly given the rapid convergence of demographic behavior between rural and urban areas over the past few decades. A number of more contemporary studies have found migration in Thailand to be highly selective on a number of criteria, including gender, age, education, marital status, and social and economic expectations (Entwisle and VanWey 2000; Guest 1996; Guest et al. 1994), suggesting that this process may play an important role in shaping the relationship between migration and fertility. However, the majority of work in this area has either been based on data collected using a retrospective design, or has not focused specifically on the implications of this for fertility behavior.

This research examines a relatively unexplored aspect of the relationship between migration and fertility in a setting of rapid social, economic, and demographic change. While there is considerable consensus in the literature that migration experiences influence fertility behavior, the role that different types of migration play in this remains unclear, particularly with regard to shorter-term migration flows, which are particularly important in this setting. Of the four explanations for the effect of migration on fertility, the disruption and selection hypotheses are expected to be particularly relevant in this context, for the reasons discussed above. While the role of selection has received considerable attention, relatively few studies have focused on the ways in which selectivity may influence the relationship between migration and fertility in the context of shorter-term migration. This issue is particularly important given the rapid increases in shorter-term migration that have come to characterize the development process in a wide range of settings.

Data and Setting

The setting for this study is Nang Rong, a relatively poor, predominantly rural district in the Northeast region of Thailand. Considered part of a broader agricultural frontier until relatively recently, Nang Rong has undergone a series of remarkable social, economic, and demographic changes over the past fifty years. Initially a net recipient of migrants, by the mid-1960s Nang Rong had become a major source of migrant labor for urban areas, with migrants being drawn by the booming economy in both Bangkok and the cities on Thailand's eastern seaboard. Roughly at the same time, fertility rates in the region began a dramatic decline, falling from an estimated level of well over seven births per woman in the 1960s (Knodel, Chamratrithirong and Debavalya 1987) to 2.19 by the end of the 1980s (Hirschman et al. 1994). Recent research has found that a strong normative preference for two children has emerged in the wake of this exceptionally rapid fertility transition (Guest 1999; Hirschman et al. 1994).

As was the case throughout rural Thailand, the pattern of migration to urban areas that emerged during the 1960s was predominantly circular in nature, and involved a significant proportion of the population (Fuller, Lightfoot and Kamnuansilpa 1985; Guest et al. 1994). By the 1990s, the Northeast ranked second only to Bangkok in terms of rates of migration, with 20 percent of men and 13 percent of women reporting having recently experienced migration (Chamratrithirong et al. 1995; De Jong, Johnson and Richter 1996; Guest 1996). At this point in time, seasonal and repeat migration movements accounted for over half of all migration in the Northeast, while making up over 35 percent of all migration within Thailand (Guest et al. 1994). While there was a brief reversal of migration patterns following the financial crisis between 1997 and 1999, which greatly reduced the employment opportunities in urban areas, migration remained an important source of income for most households in Nang Rong throughout the period covered by this study.

The data used in this study to explore the relationship between migration and fertility come from a series of three linked surveys conducted in Nang Rong in 1984, 1994, and 2000 as part of a larger project examining the interactions between social, demographic, and environmental change in Nang Rong[1]. In each of the three waves of data collection, information was collected on all households and individuals in 51 1984 study villages[2]. In the latter two waves of data collection, retrospective life history information on residential, occupational, educational, and fertility experiences were collected for all individuals. In the 1994 wave of data collection, this information was gathered for all household members aged between 13 and 35, while in 2000 the ages ranged from 18 to 41. In cases where life history information was gathered in both waves of data collection the information was combined to create a single dataset. In addition, migrants from a subsample of 22 villages to the most common migrant destinations were tracked and interviewed, providing life history information for current migrants[3]. In 1994, only migrants to the four most common urban destinations (Bangkok, the Eastern Seaboard, a regional city Korat, and the provincial capital Buriram) were included in the migrant follow-up, while the 2000 wave also collected information on rural-to-rural migrants. While rural-to-rural migration may influence fertility behavior in a number of ways, this study focuses on migration to urban areas, which typically involves more dramatic changes in social and economic context.

In this paper, I use the life history information to examine the predicted effects of the assimilation, adaptation, disruption, and selectivity hypotheses on the likelihood of experiencing a birth in any given year. The ages, periods, and cohorts potentially available for analysis are shown in Figure 1. Person-year information is available between 1972 and 2000 for all eligible

[1] For more information on this project, see http://www.cpc.unc.edu/projects/nangrong_home.html.

[2] Due to administrative subdivisions, the number of villages included in the data increased to 76 by 1994, and 92 by 2000. In order to ensure a consistent frame of reference for change at the village level, villages that had divided by either 1994 or 2000 were recombined to represent their 1984 village.

[3] The 22 villages were selected randomly within strata generated using general location and distance from paved roads in 1984.

individuals, and in 2001 for individuals included in the migrant follow-up. The ages of the individuals in the dataset are shown in the rows, while cohorts are represented by the diagonals running from left to right. The analysis is based on the yearly information of ever-married women aged 18-35 in the calendar years between 1994 and 2000 for whom information was collected in each of the three waves of data collection[4]. These person-years are bolded in Figure 1. The restriction of the analysis to this group is done for a number of reasons. The first is that this allows me to include in the analyses information on women's household and community characteristics, which was gathered only in the cross-sectional surveys. By restricting the analyses to the years between 1994 and 2000, I am able to use the information from both the 1984 and 1994 waves of data collection, providing important information on the context within which fertility decisions are made. In addition, these ages are particularly important for a number of demographic events of interest to this research. In particular, women in this context begin to undertake independent migration in their mid-to-late teens (Knodel, Chamratrithirong and Debavalya 1986; Richter et al. 1997), and have typically married by their mid twenties (Jampaklay 2003). Given the relatively high prevalence of contraceptive use in this context (Chamratrithirong et al. 1997; Entwisle et al. 1996; Rindfuss et al. 1996a), few women can be expected to continue to have children following age 35, meaning that this age range very effectively covers the prime reproductive stage of these women's life course. Had I opted for a cohort design, a significant portion of the person-years available would have been excluded either because they fell outside of the appropriate age range or because they occurred before 1984 when there was no available information on the characteristics of their households and communities. In addition, this design is ideally suited to the examination of the effect of

[4] While not included in the analysis, the information from person-years outside of this range was used for the construction of a number of time-varying variables that were included in the analysis.

important events that have the potential to influence fertility, such as the financial crisis that struck in 1997.

I include only ever-married women in 2000, for two reasons. The first is that this was the only group for whom life-history information on births was collected. Secondly, because fertility overwhelmingly takes place within marriage or its equivalent in terms of consensual unions in Thailand (Knodel et al. 1987), I consider non-married women as not being at risk of experiencing a birth[5]. I also restrict the sample to only those women from the twenty-two villages that formed the basis for the migrant follow-up, allowing me to compare the characteristics of current migrants with non-migrants and return migrants. It is important to note that this does not capture the entire population of migrants, for two reasons. The first is that not all migrants were followed up, as the 2000 migrant follow-up only attempted to track migrants to a number of designated locations. The second is that not all the target migrants were successfully found and interviewed[6]. Although the analysis is based on life history data from all women, and migrant status is based on this data and not on migrant status in 2000, this is relevant to the analyses because current migrants in 2000 are probably more likely to have also been migrants during the period covered by this study. Finally, only those women for whom information was available in each of the three waves were included in the analysis. This allows me to include information on their household and community characteristics from each of the waves of data collection in the analysis, in addition to the yearly life history information.

[5] The definition of marriage used in the collection of data included both legal marriages and consensual unions that the respondent considered marriages.

[6] In 1994, 65% of migrants who were reported to be in one of the top four migration destinations (Korat, Buriram, the Eastern Seaboard, and Greater Metropolitan Bangkok) were located and interviewed (Rindfuss, Chattopadhyay, Kaneda, and Sethaput (Forthcoming). While response rates have not been calculated for the 2000 waves of data collection, these are expected to be comparable.

A number of the features of these data are particularly well suited to the analysis of migration and fertility. Its prospective design permits a detailed picture of the changes taking place over time in individuals, households, and communities. This is particularly useful when comparing the behavior of migrants to non-migrants in the sending village, as the effects of broader change independent of migration can be isolated. In addition, because the characteristics of every individual in the village are known from 1984 onwards, a detailed and accurate assessment can be made of the processes through which migrant selectivity operates in this context. The collection of life history information from both individuals in the village and the migrant follow-up is particularly important for this study, as it allows the temporal order of events in the life course to be clearly determined. This also enables the creation of a much more detailed definition of migration status than is possible using cross-sectional data. In particular, the availability of yearly data on residence allows for an explicit inclusion of a time element in defining migration status, a particularly important issue in discerning differences between short- and long-term migration experiences. These data also make it possible to examine repeated movements such as those involved in circular migration patterns.

A further benefit of this type of data is that it makes possible the examination of the timing of events relative to the general life course, including those central to family formation. This allows a more complete assessment of the ways in which the effect of migration may differ depending on both family formation and life course stage. Finally, the use of this data allows the study of return migration, and the role selectivity issues play in this process. While the role of selectivity in the process of migration is well documented, the use of solely retrospective information on migration flows has hindered a complete assessment of the degree to which this matters for a number of behavioral outcomes[7].

Modeling Strategy and Variable Measurement

The primary objective of this paper is to examine the ways in which migration and fertility are related in this context, using a more refined measure of migration status that includes both short- and long-term migration flows separately. I use discrete-time event history analysis to explore these questions, taking advantage of the life history information included in the data. In order to capture any potential differences in the effect of migration on fertility between women at different stages of the family formation process, I modele the determinants of a birth for low parity women, defined as women with one child or less in any particular person-year, and higher parity women, or those with two or more children, separately. This division reflects the two-child norm prevalent in Thailand throughout the study period. This is supplemented by two additional analyses exploring the roles of migrant selectivity and endogeneity in shaping the estimated effects of migration on fertility generated by the hazard analysis. The selectivity analysis focuses on the determinants of migrant status, using logistic regression techniques to examine whether women were migrants in any given person-year. I explore the issue of endogeneity by comparing the estimates generated by a model that does not take the potential endogeneous nature of the analysis into account with those generated using a bivariate probit approach for single years. This approach allows for a general assessment of the bias that may be

[7] It is important to note however, that while I am able to explore the issue of selectivity to a greater extent than is true for the overwhelming majority of studies of this type, the pool of respondents from which information is collected is limited in a number of ways, meaning that a truly comprehensive assessment of the role of selectivity is not possible. This is particularly true for people who were migrants in 2000, as the study only sought to track those migrants who moved to the four target destinations. In addition, there is no information on those migrants to target destinations but who were not located in the destination. Despite these limitations, this study is still in a considerably better position to explore the issue of selectivity than virtually all other studies conducted in this area.

present in the results of the hazard analysis. Together these analyses provide further insight into the relationship between migration and fertility.

The analysis of births is based on a sample of 1715 women who met the sampling criteria described above and for whom complete information was available on each of the variables of interest to the study[8]. The discrete-time analysis of births is based on these women, who contribute a total of 9751 person-years to the analysis. The bivariate probit analysis is based on this same sample of women, while migration analysis is based on the complete sample (i.e. this includes person-years before first marriage), which includes 10678 person-years, enabling an examination of the role of marriage in shaping migration behavior[9].

The type of longitudinal data used in this study is particularly well suited to the use of event history analyisis techniques, which allow for the inclusion of time-varying variables in addition to variables that do not change over time (Allison 1995). A key concept within the framework of life history analyses is that of spell, which in this case refers to the period of time, measured in years, between the exposure to risk of a birth and the occurrence of a birth. In the case of women who have no children at the beginning of the interval, the spell refers to the period between first marriage and first birth (or the end of the observation period), while for those with children the spell refers to the period between births. Individual women may contribute multiple spells to the analysis, or may remain in a single spell for the duration of the 1994-2000 period. 148 women contributed a single spell to the analysis (i.e. experienced a

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[8] The total number of women who met the criteria for inclusion in the analysis was 1866, of whom 149 had incomplete information on one or more variables and were removed from the analysis dataset via listwise deletion (8%).

[9] These person-years include years prior to 1994 for some women, as information from these years was used in the analysis in the form of lags.

single birth), while 720 women contributed multiple spells to the analysis. 847 women did not experience a birth during the period, and are right-censored[10]. I begin by describing the discrete time event history model, and the variables included in the analysis. This is followed by a description of the approach taken to address the issue of migrant selectivity. I then describe the bivariate probit model used to explore the role of endogeneity in shaping these results.

Discrete-time Event History Analysis

The selection of the discrete-time method of event-history analysis is appropriate for this study given that the information gathered via the life history calendar was collected on a yearly basis, meaning that the exact timing of events is unknown. The dependent variable in the fertility analysis is a dichotomous variable indicating whether a birth took place in that person-year or not. The independent variables, measured in each person-year, include information on the characteristics of the woman, her household, and the origin community, and are time-varying. The estimation is based on the logistic specification of the discrete-time event history model, where a logistic regression model is applied to dataset of pooled individual person-years (Allison 1995). The regression equation is:

$$\log\left(\frac{P_{it}}{1-P_{it}}\right)=\alpha_t+\beta_1 X_{i1}+...+\beta_k x_{ik} \qquad (1)$$

[10] While most analyses of this type must also take into account left-censoring (i.e. spells that begin at some undefined time before the observation period starts), this is not an issue in this analysis because I have complete birth histories for all women included in the analysis. I am able to combine these with information on age at first marriage to construct a complete record of both the relevant intervals (first marriage to first birth and then the intervals between births). As a result, the exact length of each spell is known, including those that began prior to 1994.

where P_{it} is the conditional probability of an individual experiencing a birth at time t. Time (t) in this case is the duration at risk of experiencing a birth of a given parity, and not calendar time or age. β is the vector of coefficients representing the independent variables included in the analyses (X_{it}). To ensure the temporal order is consistent with the argument that the independent covariates cause fertility, I lag all of the independent variables by two years, reflecting the delay between the deciding to have a child and the birth of the child (a nine month pregnancy plus a five to seven month period while waiting for conception)[11]. The term α_t represents the baseline hazard of progressing to the subsequent parity, varying over time. The baseline hazard in all models is non-parametric, with no specific functional form. In the fertility analysis, spell duration is specified by a series of dummy variables capturing the length of the interval between births. In order to account for the repeated nature of births, I include a variable with information on prior spells: the number of prior spells an individual has experienced, including the interval between marriage and first birth (see Box-Steffensmeir and Jones 2004, p. 160 for a discussion of the relative merits of this approach). In addition, all models are corrected for clustering at the individual level using the Huber/White/Sandwich robust estimate of variance (StataCorp 2001).

The analysis includes a range of individual, household, and community independent variables, all of which are time-varying. The explanatory variable of primary interest in the fertility analysis is migration status. In keeping with other studies examining different types of migration flows, I define migration status in each year on the basis of the number, length, and frequency of migration movements (Guest et al. 1994; Massey 1987; Ogena and De Jong 1999). Five categories of migrants are included and are defined as follows: non-migrants are those

[11] Sensitivity tests were also conducted to examine whether the length of the lag influenced the results of the empirical analyses, with all models estimated with a lag of a single year, rather than two years. This did not significantly alter the findings or conclusions reached by these analyses, and as a result the two-year lag was retained.

individuals who lived in the origin village for the whole year; settled migrants are those who have lived continuously in an urban area for three years or more; recent migrants are those who have lived continuously in an urban area for two years or less; circular migrants are those who completed a cycle between an urban and rural area either within the year in question or over the prior two years; and return migrants, who are those who returned to the village from an urban area within the year in question or the year before[12]. While the effect of migration on fertility is likely to be relatively small given the low fertility prevalent in Nang Rong during this period, it is anticipated that the likelihood of experiencing a birth will be lower for migrants, both because of the disruptive effect of migration and the effect of living in the somewhat lower fertility environment prevalent in urban areas. In order to address the cumulative effect of past migration, the total number of months spent living in an urban location between age 13 and 1994 is also included in the analyses[13]. This variable is also expected to have a negative impact on the likelihood of a woman experiencing a birth, reflecting both the increased disruption associated with repeated migration events and the effect of assimilation on fertility preferences and behavior.

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[12] This definition uses information from multiple person-years, including those of the prior two years. As a result, information from person-years prior to 1994 is used in the construction of the 1994 and 1995 migration status variables, although only person-years between 1994 and 2000 are included in the analysis.

[13] Respondents were asked to list all the locations they had lived in for two or more months in each year, with a maximum of six residences per year. However, there was no information on exactly how long was spent in each residence. In order to create an estimate of months spent in urban areas, two approaches were explored. The first divided the year equally between all listed residences (i.e. an individual reporting two residences in a given year was assigned a residence length of six months for each residence). The second approach assigned the minimum of two months to all urban residences, thus probably undercounting time spent in urban areas (individuals who only reported an urban residence in a year were assigned 12 months in an urban area). The months spent in an urban location between age 13 and 1994 were then summed. Models were estimated using both measures of migration experience in order to establish if the effects of migration were influenced by which of these two variables was used. The results of these analyses showed no significant differences between the two definitions, so the more conservative measure was used.

The additional individual-level variables included in the analysis are: age and its squared term, occupation (agricultural, construction, other non-agricultural, and not in the labor force), education level (completed years of formal education), years since first marriage, and a series of dummies indicating the length of the current interval. Because the exact timing of the birth during the year is unknown in the data, the midpoint of the year was used. A length of 0.5 years was assigned when the length of the interval was less than one year, such as when marriage and a birth took place within the same year. In addition, because there were very few births at intervals over 12.5 years in length, the lengths above this point were combined. In statistical terms, this is the equivalent of assuming that the hazard of a birth following this point is constant. This assumption is relatively safe in this context, where completed fertility is low and births are typically relatively closely spaced. The likelihood of a birth is expected to be lower for older women, those in non-agricultural occupations, those with more children, those that have been married longer, and those who have more experience living in urban areas prior to 1994.

The household characteristics included in the analyses are: household size, dependency ratio within the household, whether the household is multigenerational (which Rindfuss, Morgan and Offutt 1996bfind increases fertility in this context), the relative wealth of the household (based on asset ownership), and the education level of the most educated person in the household. These variables may influence fertility in a number of ways. Women from larger households with more dependents may respond by reducing their fertility, particularly if the household is also poor. Alternatively, those from multigenerational households and/or relatively low educational levels may face greater pressure to have a birth.

The community-level variables included capture the degree to which the communities within which these women lived prior to migration are integrated into the modern economy. The variables included are: the distance to the nearest health center and hospital, whether the village had a primary school, the percentage of adults aged 15-45 with a non-agricultural occupation, the percentage of women of reproductive age using modern contraception, the percentage of teens aged 13-18 currently enrolled in school, and the percentage of households in the village that were poor. It is anticipated that those women from less developed villages (i.e. further from health care services, without a primary school, with lower percentages in non-agricultural employment, using contraception, and teens in school, and with a higher proportion of poor households) will be less likely to have a birth. In addition, a dummy indicating whether the person-year was prior to or after 1997 was included to capture the effect of the economic crisis that struck Thailand beginning in 1997 was also included. Given the increased poverty and hardship that resulted from the crisis in Thailand as a whole, I expect that the likelihood of a birth will be lower following the crisis.

Table 1 presents the descriptive statistics for the independent variables used in the logistic discrete-time models of fertility behavior, disaggregated by migration status. In the case of the individual level variables, these vary year-by-year, and are based on information gathered using life histories[14]. In contrast, the household and community level variables are based on data collected in the 1984 and 1994 waves of data collection. Because these change over time, they are also considered time-varying, but this variation is not year-by-year. Rather, the household and community information from the 1984 wave of data collection is used in all the years prior to 1994, and the information from the 1994 wave for all years between 1994 and 2000[15].

[14] This is also true for parity, which was created by combining the information on previous births collected in 1994 with the yearly information on births collected as a part of the life history calendar.
[15] While the analysis focuses on births in the years between 1994 and 2000, information from years prior to 1994 is included in the analysis in the form of lags.

Non-migrants are on average older, more likely to be employed in agricultural employment, less educated, have been married longer, have more children, and have spent much less time in urban areas prior to 1994 than migrants, particularly those who are more established in urban areas. In addition, non-migrants have more children than migrants, partly a reflection of their higher average age and greater time spent in a marital relationship. Some interesting differences are also evident between the different migrant groups. Migrants with a shorter time in the destination are more likely to employed in construction, which provides shorter-term employment, while more established migrants were more likely to be employed in more established non-agricultural employment. Both circular and return migrants are more likely than recent or settled urban migrants to be employed in the agricultural sector, although both are also more likely to be employed in non-agricultural occupations than non-migrants. Settled migrants have also on average much more experience living in urban areas prior to 1994, suggesting that their choice to settle more permanently is a continuation of a pattern of extended residence in urban areas. In contrast to these individual-level differences between groups, there is relatively little difference between the migration groups in terms of household and community characteristics, suggesting that the primary determinants of migration status in this context are individual characteristics.

Migrant Selectivity Analysis

In order to examine how the process of migrant selection influences the results generated by the discrete-time analysis of fertility behavior, I focus on the determinants of migration to an urban area in any given person-year. However, in this analysis I greatly simplify the migration status variable, including a dummy variable indicating whether a woman was a migrant at all in that person-year. I use logistic regression techniques to determine the extent to which this is dependent on individual, household, and community characteristics, with the dependent variable being a dichotomous variable indicating whether the woman was a non-migrant or not in any given person-year. The independent variables are the same as those in the fertility analysis, with the exception of the years since first marriage variable and the dummy variables indicating the length of the spell between births. These variables are all lagged by one year, again reflecting the temporal order of the migration decision-making process, with the lag between the decision to migrate and that actual event being smaller than that for fertility.

Endogeneity Analysis

The role of endogeneity in influencing the results of the fertility analysis is explored using a bivariate probit modeling approach. This approach differs in a three important ways from the discrete time approach described above. Firstly, this technique is best suited to examining relationships at single points in time, rather than across time as is the case for event history methods. In order to accommodate this, I examine each calendar year separately from the other, including all women aged 18 to 35 that year in the analysis. Secondly, in order to both simplify the analysis as much as possible and meet the needs of the modeling techniques I adopt, the dependent variable is again a dummy variable indicating whether a woman was a migrant at all in that person-year, as is the case for the selectivity analysis described above. Thirdly, this analysis is not stratified by parity, primarily because the restriction to a year-by-year analysis does not result in sufficient sample sizes for the analysis of sub-sample groups.

I begin by estimating a 'naïve' probit model of the determinants of fertility that does not take into account the potential endogeneity of migration, with the dependent variable being a dummy variable indicating whether a woman experienced a birth at time *t*. The model is specified as follows:

$$F_{it}^{*} = \beta_1 X_{1t-2} + \beta_2 Mig_{it-2} + \varepsilon_{it} \quad \text{where } F_{it} = 1 \text{ if } F_{it}^{*} > 0\text{, 0 otherwise.} \qquad (2)$$

where F_{it}^{*} represents a woman's latent propensity to experience a birth at time *t*; X_{1t-2} refers to a vector of the individual, household, and community characteristics influencing fertility described in the discrete-time model, lagged by two years; Mig_{it-2} is a dichotomous categorical variable indicating an individual's migration status, lagged by two years; and ε_i refers to the disturbance term, which is normally distributed, N(0,1).

To account for the potential endogeneity between migration and fertility behavior I estimate bivariate probit models for fertility and migration and allowing the errors of each equation to correlate with the other. This approach is based broadly on the principle of seemingly unrelated regressions model (Greene 2000). Implementing this approach requires each of the outcome variables be dichotomous, including that of migration, as discussed above. This model is specified in the following way:

$$F_{it}^{*} = \beta_1 X_{1t-2} + \beta_2 Mig_{it-2} + \varepsilon_{it} \quad \text{where } F_{it} = 1 \text{ if } F_{it}^{*} > 0\text{, 0 otherwise.} \qquad (3)$$

$$Mig_{it-2}^{*} = \beta_1 X_{1t-3} + \mu_{it-2} \quad \text{where } Mig_{it-2} = 1 \text{ if } Mig_{it-2}^{*} > 0\text{, 0 otherwise.} \qquad (4)$$

$$\mathrm{E}[\varepsilon_{it}] = \mathrm{E}[\mu_{it-2}] = 0$$

$$\text{Var}[\varepsilon_{it}] = \text{Var}[\mu_{it-2}] = 1$$

$$\text{Cov}[\varepsilon_{it},\mu_{it-2}] = \Omega$$

As with F^*_{it}, Mig^*_{it-2} refers to the latent propensity to be of a given migrant status. In keeping with the hypothesized relationship between these variables and the occurrence of a birth, these variables are lagged by two years, while the variables in the migration equation are lagged one additional year. X_{1t-2} and X_{1t-3} are vectors of individual, household, and community variables influencing fertility and migration respectively. ε_{it} and μ_{it-2} are the disturbance terms for each equation, while Ω is a 2x2 covariance matrix for the two disturbance terms. The role of the time lags in these models is twofold. Firstly, as in the discrete-time model, these lags are theoretically justified, as the fertility decision and the actual birth do not take place simultaneously. Secondly, the inclusion of these lags aids in the identification of the model.

I then compare the estimated coefficients generated by this model with those of the 'naïve' model described above, focusing particularly on how the estimated effects of migration and marriage change once endogeneity is accounted for. In contrast to the discrete-time analysis, I do not model the likelihood of births separately for low and high parity women. This is primarily for practical reasons, as the number of births to higher order women in individual years was in some cases too small for meaningful statistical analyses.

Results

In this section, I begin by presenting the results of the three components of the analyses separately, highlighting the key findings of interest to this paper. I then follow this with a discussion of the implications these analyses have for the relationship between migration and fertility in this context. Table 2 displays the results from the discrete-time logistic regression models estimating the occurrence of a birth for low parity women (one child or less), high parity women (two children or more), and the full sample. The variables included in all models are the same, with the exception of the dummy variable indicating an interval length of 0.5 in the model for high parity women[16], and are all lagged by two years[17]. While there are a number of findings of note in Table 2, in keeping with the focus of this paper the discussion of the results is focused primarily on the role of migration status and experience on the likelihood of experiencing a birth. The most striking feature of these results are the differences between the models for low and high parity women, particularly in terms of the effect of both migration status and past experience. For lower parity women, having been a migrant at time *t*-2, which approximates the period when the fertility decision was made, has a strong positive effect on the likelihood of experiencing a birth, regardless of the permanence of the migration status. This effect is strongest for those who were circular migrants, who are over 60 percent ($\exp^{0.401}$=1.61) more likely to have a birth in any given person-year than women who were non-migrants, although those who were settled or recent migrants are also approximately 50 percent more likely to experience a birth than non-migrants. These findings are particularly interesting given the negative effect of migration experience between age 13 and 1994, with each additional month spent as a migrant reducing the likelihood of having a birth by approximately two percent. A second finding of interest to this study is that there is relatively little difference in the effect of the different migration statuses on fertility behavior. While there are differences in the

[16] Among this group of women there were no births in this interval. As a result, the person years in this interval were combined with the interval length of 1.5. This assumes that the hazard is constant for this group of women for the first 1.5 years following their previous birth.

[17] The exception to this is the number of previous intervals a woman has had, which is not lagged. This variable is included primarily in order to account for the potentially repeated nature of the outcome (births), and as such has no direct interpretation of relevance to this research.

magnitude of the effect of migration status on fertility, both being either a permanent and temporary migrant at time *t*-2 encourages births for lower parity women, while neither has a statistically significant effect on births for higher parity women. Being a circular migrant at time *t*-2 has the greatest effect on fertility, increasing the likelihood of having a birth by over 60 percent relative to non-migrants. This compares to 55 and 49 percent for recent and settled migrants respectively, while return migrants did not differ from non-migrants to a statistically significant degree.

In contrast, both migration status and previous migration experience have no statistically significant effect on the likelihood of experiencing a birth for higher parity women, for whom the only individual level variables that influenced the likelihood of a birth were having a non-agricultural occupation other than construction and years since first marriage. The effect of the latter variable confirms that women who have been married longer and are therefore towards the end of the family formation process are less likely to have a birth, while the positive effect of the former suggests that the additional income gained by non-agricultural employment encourages fertility. It is interesting to note that this has the opposite effect for lower parity women, for whom a non-agricultural occupation other than construction lowers the likelihood of birth. The fertility behavior of these women was also more responsive to household and community factors than that of lower parity women.

The results of these analyses indicate that the relationship between migration and fertility in this setting is more complex than that posited by either the assimilation, adaptation, or disruption hypotheses, and suggests that migration is related to the family formation process in a broader way than is addressed by these approaches. The combination of the strong effects of both migration status at time *t*-2 and cumulative migration experience for lower parity women with the lack of any effect for women of higher parities suggests a linkage between migration and family formation that goes beyond a direct influence on fertility behavior. In addition, while the negative effect of cumulative migration experience on fertility is consistent with both the assimilation and disruption hypotheses, the strong positive effect of migration on fertility is contrary to the expectations of each of the assimilation, adaptation, and disruption hypotheses. This suggests that the relationship between fertility and migration in this context is to a significant extent a reflection of unobserved migrant selectivity related to the family formation process.

In order to explore this further, I now turn to the analysis of the determinants of migration status. The results of the logistic regression model predicting whether a woman was a migrant in any given year are presented in Table 3. The variables included in the models are the same as those used in the analysis of births, with the addition of marital status and parity and the removal of years since first marriage[18]. As expected, migration status is influenced by a variety of factors, particularly at the individual level. Of the variables indicating family formation stage, only age had a significant effect on being a migrant the following year, with each additional year of age increasing the likelihood of being a non-migrant by over 50 percent. Women with non-agricultural jobs or who were not in the labor-force in the previous year were significantly less likely to be non-migrants, suggesting that in part the decision to migrate is based on both non-agricultural skills and financial ability to migrate. However, these results should be interpreted with some care, as this may in part be capturing migration status from the previous year, as urban

[18] The information on the marital status of respondents was collected only as a part of the three waves of data collection. As a result, women are categorized only as 'ever-married' for the person-years following their reported age at first marriage, and 'never-married' for the person-years before that. This definition ignores changes in marital status, such as through divorce, which is relatively common in Thailand (Limanonda 1992). Never-married women were assigned a parity of zero. A squared term for parity is also included in the model in order to capture any potentially non-linear relationship between parity and migration status. Years since first marriage was removed from the equation because this analysis includes women who had not been married.

migrants in this context are overwhelmingly employed in non-agricultural occupations. Finally, women with more migration experience between age 13 and 1994 were considerably less likely to be non-migrants, with each additional month spent in an urban area during this period reducing the likelihood of being a non-migrant by 14 percent. This suggests that the experience of migration changes both attitudes and perceptions that encourage future migration, a finding consistent with approaches to understanding of migration that emphasize the role of cumulative causation (see Massey et al. 1994 for a discussion of this approach and the empirical evidence supporting it). Finally, women were considerably more likely to be a non-migrant after the economic crisis that started in 1997, reflecting the decreased employment opportunities for migrants following the crisis.

Relatively few of the household and community-level variables had a statistically significant effect on migration. At the household level, the only factor influencing migration status in the following year was whether the women came from an extended multigenerational household, which decreased the likelihood of a woman being a non-migrant. There are a number of reasons for why this household structure may encourage migration. In particular, women from these households may be able to rely to a greater extent on their parents as a source of childcare for their children, making migration a more feasible option. In addition, these women may migrate in order to raise funds in anticipation of having to care for both their elderly parents and children simultaneously at a further point in time. At the community level, both distance to the nearest health center and distance to the nearest hospital encouraged migration, while having a primary school in the village discouraged it. This suggests that women from villages with a less developed infrastructure are more likely to migrate, possibly because these villages offer less in the way of opportunities for personal advancement.

The results of this analysis suggest that migration is selective of younger women from less privileged backgrounds who have prior experience with both migration and non-agricultural employment. While the analysis does not provide direct support for a linkage between migration and the family formation process, the selection of these women into migration may be related to family formation, and particularly union formation, in a number of ways. Firstly, prior research has found that migrant women who worked in non-agricultural occupations were significantly more likely to marry, largely as a result of exposure to a larger pool of potential partners, although this differs somewhat between professions (Jampaklay 2003). The strong effect of non-agricultural employment in the prior years suggests that these women have been previously exposed to this environment, and are likely to have non-agricultural employment in the destination location. Secondly, while family formation stage is not a strong factor in selecting migrants, this does not necessarily imply that migration does not encourage union formation once the migrant is in the destination.

The results of the analysis of the effect of endogeneity on the estimated effect of migration are presented in Table 4. For ease of presentation, only the individual level variables for the analysis of fertility are presented. Two sets of results are presented for each year in the analysis. The first are those of the naïve model, which does not take into account endogeneity, while the second are those of the bivariate probit. The equation for migration behavior includes all of the variables used in the fertility analysis, with the exception of information on interval length and the number of previous intervals. In addition, the lag used in the migration equation extends one year beyond that of the fertility equation (i.e. the lag used is of three years).

The results of this analysis largely confirm the findings of the discrete-time analysis, and do not present a challenge the validity of the results of this analysis. Weak statistical evidence of endogeneity was found in only two of the seven years covered by this study. The two years were 1995 and 1997, for which the p-value of the Wald test of the rho was 0.0990 and 0.0838 respectively. While taking endogeneity into account potentially may change the effect of a number of explanatory variables, I focus on the effect of the migration variable as this is the variable of primary interest to this paper. In 1995, the dummy variable for migration status was statistically insignificant in both the naïve probit model and the bivariate probit model, although the direction of the effect was different (the only year where this was the case), and total urban experience became significant when endogeneity was taken into account (although the direction of the predicted effect remained the same). The only difference between the two models in 1997 was the magnitude of the coefficient for the migration dummy variable, which approximately doubled. These results suggest that while the relationship between these processes may be endogenous, this does not necessarily result in seriously biased coefficient estimates and in neither case did this alter the relationships established by the discrete-time hazards approach. This is likely due to the incorporation of lags into both sets of analyses, which establishes a clear temporal order for the relationship between the two processes.

These analyses together provide strong evidence that the relationship between migration and fertility in this context is influenced to a significant extent by the ways in which the overall family formation process is related to migration. While the negative effect of cumulative migration experience on fertility lends some support to the assimilation and disruption hypotheses, the results of both the discrete-time event history and bivariate probit analyses suggest that the effect of migration on fertility appears to be related to factors other than those addressed by the standard hypotheses explaining this relationship. As implied in the discussion above, the most plausible explanation for the results of the discrete-time analysis is that the migration process in this context is selective of groups of individuals at early stages in the family formation process. As a result, these individuals will be more likely to marry in any given year and, given the close temporal link between marriage and parenthood in this setting, also to have a birth. While the selection analysis provides mixed support for this approach, the selection of younger women with prior experience in non-agricultural occupations into migration is likely to result in increased rates of marriages and, by extension, births. This is supported by the strong effect of shorter-term migration movements, which often involve situations where large groups of migrants are housed in relatively close proximity, increasing the likelihood of finding a marital partner while a migrant. While this argument is broadly consistent with the selectivity hypothesis, these results are more suggestive of the type of framework suggested by Singley and Landale (1998), who argue for a broader conceptualization of this approach that explicitly acknowledges of the role of migration in the process of family formation.

Conclusions

The emergence of high levels of population mobility is one of the more pervasive features of the contemporary development process, particularly when temporary migration flows are taken into account. However, while the effect of migration on fertility is a persistent theme in demographic research, relatively few studies have explicitly examined how this relationship differs for short- and long-term migrants, or how this is influenced by migration experience over the life course. In this paper, I explore the ways in which migration influences the fertility behavior of women in Nang Rong, Thailand, using a combination of detailed prospective cross-sectional data and detailed life-history information. These data allow me to extend prior research in this area by developing a detailed measure of migration status based on the number, frequency, and duration of migration experiences in urban areas and by explicitly exploring how the relationship between migration and fertility varies according to family formation stage. In addition, this study takes advantage of the prospective design of the data to empirically examine how the relationship between migration and fertility is influenced by selectivity, and how the empirical results are influenced by the endogeneity of the two processes. This allows for a more comprehensive analysis of the relationship between migration and fertility, therefore providing a concrete illustration of the ways in which the demographic processes of migration and family formation are related that incorporates both the insights of prior research examining the relationship between migration and fertility and those of life course theory.

The results of the analyses in this paper illustrate well the complexity of the relationship between migration and fertility, particularly in contexts of rapid social and economic change. In particular, these highlight the ways in which migration has become an integral part of the life course of many women from Nang Rong, as is the case in many rural areas of developing countries. In these contexts, migration has become an important part of an overall process of family formation that includes both union formation and fertility. This has a number of implications for our understanding of how migration influences fertility behavior, both in Thailand and in other settings of rapid social, economic, and demographic change. Firstly, the results suggest that lifetime migration experience affects fertility in ways not adequately captured by more static measures of migration status. The analyses found relatively little evidence of significant differences between short- and long-term migration in terms of their effect on fertility, with each of the of the migrant statuses that included current migrants having a positive effect on fertility. This suggests that in this context, where the fertility patterns of rural and urban areas are not markedly different and the geographical distances between origin and destination are relatively small, migration does not influence fertility through the processes described by the assimilation, adaptation, or disruption hypotheses. However, the negative influence of total time spent in urban areas does offer limited support to the assimilation and, to a lesser extent, disruption hypotheses. While appearing to be contradictory, this is consistent with the expectations of the assimilation hypothesis, which assumes that changes in preferences and behavior unfold over an extended period of time. As a result, the effects of the process of assimilation are likely to be only evident when an extended view of the life course is taken into account, suggesting that measures of migration status based on a limited range of years may not be able to adequately capture the effects of assimilation. While the measures of migration status employed in this study are unusually detailed and include information on duration of time as a migrant, the period of time they encompass is likely to be too short to see the effects of assimilation. In contrast, these measures are well suited to the examination of the effect of adaptation and disruption on fertility, and the absence of any evidence for their effects suggests that their impact on fertility in this context is limited. This is not surprising given the setting, for the reasons discussed above.

These results also imply that both life course and family formation stage are important factors in shaping the way in which migration affects fertility behavior, as is illustrated by the difference between the effect of migration status for women with less than two children and those with two or more children. This suggests that research in this area must take this into account when exploring this relationship. In addition, the role of migration in the family formation process must also be accounted for in the analysis, as this influences the way in which migration and fertility may be related. In the case of this study, accounting for the role of migration in the family formation process provides a clear explanation for the positive effect of migration on fertility found for women with one child or less, a finding that is not easily explained by the standard hypotheses explaining this relationship. Incorporating this approach is especially important in settings where migration itself can be thought of as a part of the family formation process. This may take a variety of forms and is not unique to settings such as Nang Rong where migration is very common. For example, migration for the purposes of marriage is common throughout the world, and the process of union formation itself may encourage migration as the couple seeks to establish an independent household. Alternatively, migration may be a means for gathering sufficient wealth to enable both marriage and childbearing.

This study provides general support for an approach to the relationship between migration and fertility that is based on a broader conceptualization of the role of migration in the life course, and in the family formation process specifically, as also suggested by Singley and Landale (1998). This implies a reframing and extension of existing theories explaining the relationship between migration and fertility in a way that incorporates a broader understanding of how different aspects of human behaviors are related across the life course, and how this in turn is related to the selectivity of migrants. Prior research in this area has for the most part either not been able to address these issues, or done so in a limited fashion. In large part this reflects the lack of suitable data to explore these issues within a dynamic framework that allows for the inclusion of life course information and is also able to explore the issue of selectivity in shaping these results, particularly in developing country settings. As a result, much of our understanding of the ways in which migration affects fertility is likely to be incomplete.

This study is able to address these issues through the use of yearly information on a range of variables, including migration and fertility, in combination with prospective cross-sectional data. This allowed a comprehensive analysis of the role of migration in shaping fertility behavior in a context of rapid change. While care must be taken in generalizing the findings of this study too broadly given the unusual speed and scale of the social, economic, and demographic changes that have taken place in Thailand over the past three decades, the results of the analyses conducted in this paper are broadly applicable to societies where migration is closely tied to family formation. The results suggest that there is much to gain in terms of understanding the effect of migration on fertility from the broader perspective of the life course, and that future research in this area should attempt to explicitly take into account the potential interactions between migration and other aspects of the life course, particularly the process of family formation.

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Figure 1: Age, Period, and Cohort of Individuals Included in the Nang Rong Life History Data.

Year	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01*
	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13						
		14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14					
			15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15				
				16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16			
					17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17		
						18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	**18**	**18**	**18**	**18**	**18**	**18**	**18**	18
							19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	**19**	**19**	**19**	**19**	**19**	**19**	**19**	19
								20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	**20**	**20**	**20**	**20**	**20**	**20**	**20**	20
									21	21	21	21	21	21	21	21	21	21	21	21	21	21	**21**	**21**	**21**	**21**	**21**	**21**	**21**	21
										22	22	22	22	22	22	22	22	22	22	22	22	22	**22**	**22**	**22**	**22**	**22**	**22**	**22**	22
											23	23	23	23	23	23	23	23	23	23	23	23	**23**	**23**	**23**	**23**	**23**	**23**	**23**	23
												24	24	24	24	24	24	24	24	24	24	24	**24**	**24**	**24**	**24**	**24**	**24**	**24**	24
													25	25	25	25	25	25	25	25	25	25	**25**	**25**	**25**	**25**	**25**	**25**	**25**	25
														26	26	26	26	26	26	26	26	26	**26**	**26**	**26**	**26**	**26**	**26**	**26**	26
Age															27	27	27	27	27	27	27	27	**27**	**27**	**27**	**27**	**27**	**27**	**27**	27
																28	28	28	28	28	28	28	**28**	**28**	**28**	**28**	**28**	**28**	**28**	28
																	29	29	29	29	29	29	**29**	**29**	**29**	**29**	**29**	**29**	**29**	29
																		30	30	30	30	30	**30**	**30**	**30**	**30**	**30**	**30**	**30**	30
																			31	31	31	31	**31**	**31**	**31**	**31**	**31**	**31**	**31**	31
																				32	32	32	**32**	**32**	**32**	**32**	**32**	**32**	**32**	32
																					33	33	**33**	**33**	**33**	**33**	**33**	**33**	**33**	33
																						34	**34**	**34**	**34**	**34**	**34**	**34**	**34**	34
																							35	**35**	**35**	**35**	**35**	**35**	**35**	35
																								36	36	36	36	36	36	36
																									37	37	37	37	37	37
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																														42

Note: * denotes migrant follow-up only

Adapted from Jampaklay 2003

Table 1: Descriptive Statistics for Independent Variables Used in Fertility Analyses, by Migration Status.

	Non-Migrant		Settled Migrant		Recent Migrant		Circular Migrant		Return Migrant	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Individual Characteristics										
Age	25.65	4.56	24.06	4.07	22.65	4.63	23.66	4.67	23.50	4.20
Occupation										
Agricultural	0.75	0.43	0.02	0.14	0.02	0.13	0.36	0.48	0.59	0.49
Construction	0.01	0.09	0.07	0.26	0.18	0.38	0.22	0.41	0.03	0.18
Other Non-Agricultural	0.20	0.40	0.79	0.41	0.72	0.45	0.37	0.48	0.30	0.46
Not in Labor Force	0.04	0.19	0.12	0.33	0.09	0.28	0.05	0.22	0.07	0.26
Education										
Education Level	5.73	2.20	6.39	2.49	6.48	2.42	5.78	1.69	6.03	2.02
Family Formation Stage										
Parity	1.38	1.03	0.79	0.85	0.69	0.86	1.04	1.04	0.94	0.83
Years Since First Marriage	5.38	4.35	3.91	3.94	2.87	3.85	3.82	4.30	2.95	3.55
Migration Experience										
Time in Urban between age 13 and 1994 (months)	2.02	4.13	22.14	7.78	12.45	7.22	11.14	8.31	11.18	7.18
Historical and Interval Time										
1994-1996	0.68	0.47	0.60	0.49	0.73	0.45	0.75	0.43	0.62	0.49
1997-2000	0.32	0.47	0.40	0.49	0.27	0.45	0.25	0.43	0.38	0.49
Length of Interval (years)	4.86	4.18	3.76	3.39	3.39	3.38	3.80	3.91	2.99	2.95
Household Characteristics (either 1984 or 1994)										
Household Size	5.18	2.11	4.95	2.23	4.98	2.18	5.14	2.18	4.94	2.19
Extended Household	0.60	0.49	0.59	0.49	0.55	0.50	0.61	0.49	0.59	0.49
Number of dependents	1.90	1.37	1.89	1.59	1.99	1.48	1.94	1.43	1.78	1.40

Table 1: Descriptive Statistics for Independent Variables Used in Fertility Analyses, by Migration Status (continued).

	Non-Migrant		Settled Migrant		Recent Migrant		Circular Migrant		Return Migrant	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Household Wealth										
Poor	0.28	0.45	0.31	0.46	0.27	0.45	0.35	0.48	0.34	0.47
Middle	0.53	0.50	0.53	0.50	0.57	0.50	0.51	0.50	0.49	0.50
Rich	0.19	0.39	0.16	0.36	0.16	0.37	0.14	0.35	0.17	0.38
Education Level of Most Educated Member (years)	6.40	2.51	6.31	2.27	6.32	2.38	6.00	1.91	6.39	2.25
Community Characteristics (either 1984 or 1994)										
Distance to Health Center (km.)	2.76	1.29	2.73	1.32	2.71	1.31	2.96	1.49	2.74	1.32
Distance to Hospital (km.)	16.65	5.01	16.23	4.65	16.55	4.65	16.46	5.55	15.94	4.82
Primary School in Village	0.62	0.49	0.57	0.50	0.58	0.49	0.62	0.49	0.53	0.50
% of Adults with Non-Agricultural Occupation	20.35	9.09	22.26	8.84	20.97	9.21	21.45	8.56	21.89	8.39
% Women of Reproductive Age using Contraception	62.65	14.45	62.79	14.40	61.58	15.16	61.78	13.93	64.42	13.64
% Teens (13-18) Currently in school	31.72	12.45	33.56	12.63	32.65	11.99	31.50	12.79	33.09	12.53
% Households in Village Poor	31.86	10.73	32.50	11.76	31.76	10.35	32.33	10.00	31.64	9.85
N (person-years)	6430		941		726		834		820	

Table 2: Parameter Estimates for Discrete-Time Logit Model Predicting Birth in a Given Person-Year between 1994 and 2000 - Women Aged 18-35 in 1994-2000.

	Low Parity Women		High Parity Women		All Women	
Independent Variables (t-2)	β	S.E.	β	S.E.	β	S.E.
Individual Characteristics						
Age	-0.031	(0.047)	0.010	(0.082)	-0.025	(0.035)
Age^2	0.001	(0.001)	-0.001	(0.002)	0.000	(0.001)
Migration Status						
Non-Migrant (reference)						
Settled Migrant	0.401	(0.178)**	0.647	(0.555)	0.342	(0.171)**
Recent Migrant	0.437	(0.146)***	-0.297	(0.533)	0.335	(0.141)**
Circular Migrant	0.477	(0.135)***	0.268	(0.369)	0.426	(0.125)***
Return Migrant	0.075	(0.145)	-0.325	(0.499)	0.040	(0.138)
Migration Experience						
Time in Urban between age 13 and 1994	-0.022	(0.007)***	-0.018	(0.017)	-0.017	(0.006)***
Occupation						
Agricultural (reference)						
Construction	-0.241	(0.193)	-0.231	(0.540)	-0.235	(0.181)
Other Non-Agricultural	-0.294	(0.103)***	0.524	(0.251)**	-0.174	(0.097)*
Not in Labor Force	-0.229	(0.180)	0.489	(0.369)	-0.092	(0.163)
Education						
Education Level	0.022	(0.020)	-0.110	(0.070)	0.007	(0.020)
Family Formation Stage						
Years Since First Marriage	-0.016	(0.027)	-0.134	(0.043)***	-0.074	(0.023)***
Historical and Interval Time						
1994-1996 (reference)						
1997-2000	-0.521	(0.093)***	-0.542	(0.249)**	-0.497	(0.086)***
Length of Interval (years)						
0.5	-1.241	(0.469)***	--	--	-1.154	(0.345)***
1.5	-0.305	(0.461)	-1.978	(0.675)***	-0.271	(0.330)
2.5	-0.474	(0.469)	-0.927	(0.568)	-0.360	(0.338)
3.5	-0.365	(0.463)	-0.697	(0.586)	-0.197	(0.335)
4.5	0.025	(0.454)	0.144	(0.542)	0.284	(0.326)
5.5	-0.099	(0.452)	-0.029	(0.559)	0.173	(0.328)

Table 2: Parameter Estimates for Discrete-Time Logit Model Predicting Birth in a Given Person-Year between 1994 and 2000 - Women Aged 18-35 in 1994-2000 (Continued).

	Low Parity Women		High Parity Women		All Women	
Independent Variables (t-2)	β	S.E.	β	S.E.	β	S.E.
Length of Interval (years)						
6.5	-0.156	(0.449)	-0.450	(0.582)	0.066	(0.329)
7.5	-0.495	(0.464)	0.100	(0.534)	-0.052	(0.338)
8.5	-0.169	(0.464)	-0.249	(0.533)	0.044	(0.335)
11.5	-0.789	(0.596)	-0.075	(0.541)	-0.343	(0.385)
12.5+	-1.357	(0.604)**	-0.830	(0.549)	-1.172	(0.392)***
Household Characteristics (either 1984 or 1994)						
Household Size	-0.017	(0.035)	-0.085	(0.079)	-0.020	(0.032)
Extended Household	0.020	(0.099)	0.949	(0.233)***	0.158	(0.090)*
Number of dependents	0.011	(0.046)	0.064	(0.103)	0.010	(0.041)
Household Wealth						
Poor (reference)						
Middle	-0.096	(0.089)	-0.241	(0.215)	-0.097	(0.081)
Rich	-0.017	(0.123)	-0.042	(0.276)	-0.005	(0.109)
Education Level of Most Educated Member	0.001	(0.018)	-0.032	(0.050)	-0.004	(0.017)
Community Characteristics (either 1984 or 1994)						
Distance to Health Center (km.)	-0.038	(0.029)	-0.003	(0.066)	-0.031	(0.026)
Distance to Hospital (km.)	0.003	(0.009)	0.047	(0.021)**	0.008	(0.008)
Primary School in Village	0.139	(0.102)	-0.577	(0.248)**	0.028	(0.094)
% of Adults with Non-Agricultural Occupation	0.003	(0.006)	0.021	(0.014)	0.005	(0.005)
% Women of Reproductive Age using Contraception	-0.004	(0.003)	-0.008	(0.008)	-0.005	(0.003)*
% Teens (13-18) Currently in school	0.004	(0.004)	0.004	(0.012)	0.004	(0.004)
% Households in Village Poor	0.000	(0.004)	-0.009	(0.009)	-0.002	(0.004)
Information on Previous Intervals						
Number of Previous Intervals	-0.874	(0.090)***	-0.417	(0.210)**	-0.856	(0.083)***
Number of Observations	6202		3359		9751	

Note: * p<0.1, ** p<0.05, *** p<0.001. Numbers in parenthesis are robust standard errors.

Table 3: Parameter Estimates from a Logistic Regression Predicting Migration Status in a Given Person-Year, Women aged 18-35 between 1994 and 2000.

Independent Variables (t-1)	Non-Migrant vs. Other	
	β	S.E.
Individual Characteristics		
Age	0.411	(0.135)***
Age^2	-0.005	(0.003)*
Occupation		
Agricultural (reference)		
Construction	-3.135	(0.282)***
Other Non-Agricultural	-1.148	(0.112)***
Not in Labor Force	-1.036	(0.215)***
Education		
Education Level	0.028	(0.032)
Family Formation Stage		
Not-Married		
Ever-Married	0.100	(0.126)
Parity	0.072	(0.111)
$Parity^2$	-0.005	(0.022)
Years Since First Marriage		
Migration Experience		
Time in Urban btwn. age 13 and 1994	-0.276	(0.014)***
Historical Time		
1994-1996 (reference)		
1997-2000	0.242	(0.100)**
Household Characteristics (either 1984 or 1994)		
Household Size	0.022	(0.052)
Extended Household	-0.285	(0.156)*
Number of dependents	-0.021	(0.066)
Household Wealth		
Poor (reference)		
Middle	-0.014	(0.132)
Rich	0.077	(0.183)
Education Level of Most Educated Member	0.044	(0.031)
Community Characteristics (either 1984 or 1994)		
Distance to Health Center (km.)	-0.092	(0.045)**
Distance to Hospital (km.)	-0.024	(0.014)*
Primary School in Village	0.322	(0.146)**
% of Adults with Non-Agricultural Occupation	0.006	(0.008)
% Women of Reproductive Age using Contraception	0.006	(0.005)
% Teens (13-18) Currently in school	-0.007	(0.007)
% Households in Village Poor	0.000	(0.006)
Constant	-4.326	(1.684)
N	10678	

Note: * p<0.10, ** p<0.05, ** p<0.001. Numbers in parenthesis are robust standard errors.

Table 4: A Comparison of the Parameter Estimates of Individual Level Variables in the Fertility Model Generated by a 'Naïve' Probit Model not taking Endogeneity into Account with those From a Bivariate Probit: Year-by-Year Analysis

	1994		1995		1996		1997	
	Naïve Model	Bivariate Probit	Naïve Model	Bivariate Probit	Naïve Model	Bivariate Probit	Naïve Model	Bivariate Probit
Age	0.196	0.213	0.150	0.111	0.089	0.064	0.090	0.113
	(0.136)	(0.129)*	(0.125)	(0.113)	(0.133)	(0.116)	(0.125)	(0.108)
Age^2	-0.005	-0.005	-0.003	-0.002	-0.002	-0.002	-0.002	-0.002
	(0.003)	(0.003)*	(0.003)	(0.002)	(0.003)	(0.002)	(0.003)	(0.002)
Migration Status								
Was Migrant (dummy)	0.003	0.296	0.090	-0.488	0.175	-0.596	0.415	0.921
	(0.176)	(0.507)	(0.171)	(0.370)	(0.175)	(0.674)	(0.167)**	(0.316)***
Migration Experience								
Time in Urban	-0.006	-0.015	0.008	0.026	-0.019	0.007	-0.021	-0.037
	(0.008)	(0.017)	(0.007)	(0.012)**	(0.009)**	(0.024)	(0.008)**	(0.012)***
Occupation								
Agricultural (reference)								
Construction	0.143	0.118	-0.164	-0.056	-0.091	0.016	-0.264	-0.354
	(0.230)	(0.218)	(0.227)	(0.205)	(0.260)	(0.253)	(0.292)	(0.269)
Other Non-Agricultural	-0.164	-0.194	-0.201	-0.121	0.015	0.085	-0.024	-0.113
	(0.139)	(0.140)	(0.142)	(0.145)	(0.135)	(0.146)	(0.131)	(0.131)
Not in Labor Force	-0.236	-0.271	-0.341	-0.279	-0.353	-0.259	-0.056	-0.087
	(0.273)	(0.259)	(0.261)	(0.258)	(0.267)	(0.282)	(0.229)	(0.237)
Education								
Education Level	0.010	0.012	0.030	0.026	-0.035	-0.038	0.000	0.003
	(0.025)	(0.024)	(0.028)	(0.025)	(0.029)	(0.027)	(0.024)	(0.023)
Family Formation Stage								
Parity	0.337	0.341	-0.347	-0.362	-0.405	-0.420	-0.437	-0.44
	(0.210)	(0.195)*	(0.137)**	(0.117)***	(0.143)***	(0.119)***	(0.138)***	(0.125)***
$Parity^2$	-0.139	-0.140	0.043	0.044	0.035	0.039	0.065	0.065
	(0.070)**	(0.061)**	(0.027)	(0.020)**	(0.030)	(0.018)**	(0.021)***	(0.014)***
Years Since First Marriage	0.003	0.003	-0.007	-0.003	-0.051	-0.043	-0.009	-0.011
	(0.030)	(0.028)	(0.027)	(0.024)	(0.031)*	(0.026)	(0.026)	(0.026)
# Previous Intervals	-0.592	-0.583	-0.223	-0.231	-0.267	-0.290	-0.298	-0.282
	(0.143)***	(0.127)***	(0.125)*	(0.117)**	(0.111)**	(0.112)***	(0.107)***	(0.117)**
Constant	-4.295	-4.566	-2.310	-1.74	-0.845	-0.341	-2.031	-2.377
	(1.668)**	(1.513)***	(1.567)	(1.470)	(1.705)	(1.672)	(1.603)	(1.439)*
Rho Wald Test X^2		0.528		0.099		0.311		0.084
N	1408		1342		1354		1410	

Note: Robust Standard errors in parentheses * p<0.10, ** p<0.05, ** p<0.001

Table 4: A Comparison of the Parameter Estimates of Individual Level Variables in the Fertility Model Generated by a 'Naïve' Probit Model not taking Endogeneity into Account with those From a Bivariate Probit: Year-by-Year Analysis (Continued).

	1998		1999		2000	
	Naïve Model	Bivariate Probit	Naïve Model	Bivariate Probit	Naïve Model	Bivariate Probit
Age	0.142	0.155	-0.155	-0.141	-0.185	-0.160
	(0.138)	(0.135)	(0.133)	(0.121)	(0.154)	(0.151)
Age^2	-0.003	-0.003	0.003	0.003	0.003	0.003
	(0.003)	(0.003)	(0.003)	(0.002)	(0.003)	(0.003)
Migration Status						
Was Migrant (dummy)	0.057	0.382	0.212	0.508	0.301	0.694
	(0.185)	(0.394)	(0.176)	(0.357)	(0.197)	(0.406)*
Migration Experience						
Time in Urban	-0.011	-0.021	-0.013	-0.024	0.002	-0.011
	(0.010)	(0.015)	(0.010)	(0.014)*	(0.010)	(0.016)
Occupation						
Agricultural (reference)						
Construction	-0.734	-0.810	-0.003	-0.064	0.041	-0.044
	(0.384)*	(0.369)**	(0.269)	(0.270)	(0.332)	(0.336)
Other Non-Agricultural	-0.119	-0.165	-0.249	-0.293	0.017	-0.036
	(0.148)	(0.139)	(0.142)*	(0.139)**	(0.166)	(0.178)
Not in Labor Force	0.287	0.240	0.042	0.019	0.171	0.129
	(0.227)	(0.209)	(0.230)	(0.222)	(0.268)	(0.248)
Education						
Education Level	-0.014	-0.013	0.034	0.032	-0.006	-0.009
	(0.031)	(0.027)	(0.027)	(0.025)	(0.035)	(0.027)
Family Formation Stage						
Parity	-0.127	-0.119	-0.475	-0.470	-0.014	-0.014
	(0.183)	(0.145)	(0.171)***	(0.133)***	(0.289)	(0.245)
Parity^2	0.007	0.005	0.047	0.045	-0.041	-0.042
	(0.044)	(0.028)	(0.026)*	(0.016)***	(0.093)	(0.079)
Years Since First Marriage	-0.067	-0.069	-0.036	-0.038	0.012	0.012
	(0.035)*	(0.033)**	(0.032)	(0.030)	(0.038)	(0.037)
# Previous Intervals	-0.419	-0.409	-0.289	-0.283	-0.439	-0.429
	(0.131)***	(0.112)***	(0.130)**	(0.138)**	(0.188)**	(0.181)**
Constant	-1.204	-1.418	1.173	0.968	1.647	1.211
	(1.778)	(1.719)	(1.720)	(1.548)	(2.021)	(2.010)
Rho Wald Test X^2		0.345		0.346		0.254
N	1385		1412		1440	

Note: Robust Standard errors in parentheses * p<0.10, ** p<0.05, ** p<0.00