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INTERACTION BETWEEN RURAL/URBAN MIGRATION AND FERTILITY: DECOMPOSING THE DIFFERENCES

Abstract

This study investigates the intricate and less-explored relationship between women's migration and the fertility transition in Brazil. While some research suggests that migration may contribute to the persistence of high fertility rates, the underlying mechanisms of this interaction remain ambiguous. Contrary to expectations, other studies indicate that the fertility of migrants tends to be lower than that of non-migrants. This paper's primary objective is to investigate this relationship, focusing on understanding the patterns of rural-to-urban migration at the onset of the fertility transition in Brazil during the early 1960s. This study employs a cohort fertility approach and expands its geographic scope to encompass the entire nation, including its major regions. Our research aims to address the following key questions: (1) Do variations in fertility exist among different immigrant groups during the demographic transition? Furthermore, (2) What is the substantial impact of migration processes on reducing fertility rates? For the first question, our findings reveal a persistent fertility differential between rural-to-urban migrants and non-migrants, albeit diminishing across different cohorts but remaining notable in the North and Northeast regions. As for the second question, our analysis, based on decomposition methods, offers a positive response, with quantitative estimates indicating the significant role of migration in decelerating the pace of fertility decline in Brazil.

1 Introduction

In Brazil, fertility rates declined by more than 50% between 1970 and 1991 (MARTINE, 1996), highlighting the rapidity of the fertility transition process. Interestingly, it's worth noting that despite this rapid decline, Brazil never implemented public or private family planning policies. These changes unfolded differently among social groups and regions in Brazil. The higher-income social groups and urban areas initially pioneered the fertility decline (MARTINE, 1996; CARVALHO; WONG, 1995). The 1991 census revealed a significant decrease across all Brazilian regions and social groups. However, disparities between rural and urban areas persisted (MARTINE, 1996). Several factors can explain these rural-urban disparities, including variations in population composition based on economic characteristics, social conditions, proximity to healthcare services, cost of living, and cultural factors (ADHIKARI; LUTZ; SAMIR, 2023).

Concurrently with the fertility transition, Brazil experienced a process of urbanization. Migration was critical in redistributing the population from rural to urban areas. Notably, the South and Southeast regions were pioneers in achieving low fertility rates and urbanization. Consequently, it is expected that migration influences the decline in fertility. Therefore, comprehending the relationship between migration and fertility is imperative.

The research proposed in this study entails a comparative analysis of cohort fertility rates to ascertain if there were any fertility differences between women who never migrated and those who migrated more than five years ago. This analysis leads us to a second question: how does migration impact fertility? The study's second objective is to quantify the effect of rural-to-urban migration on fertility levels by decomposing total fertility changes into migration composition and migration-specific fertility. We aim to determine whether the fertility decline results from the migration process and whether the pace of the Brazilian fertility decline would have been different without internal migration.

The primary goal of this work is to provide insights into the extent of migration's impact on fertility. To achieve this, we will employ two methods. The first method is decomposition, where we will compare two approaches, Kitagawa (1955) and Canudas-Romo (2003). Although introduced in 1955 by Kitagawa, decomposition is underutilized, especially in the context of fertility, as it is more commonly applied in mortality research. One criticism of the decomposition method is whether the results imply causality. However, despite these criticisms, this method can contribute to discussing fertility and migration.

2 Data and Methods

For the analyses in this study, we used data from the 1970 and 1980 Demographic Censuses. We have chosen women born between 1921 and 1945, ensuring they were between 35 and 50 years old during the censuses. Using migration variables obtained from the censuses, such as previous and current residence status, we categorized individuals into various migration groups. These groups included non-migrants from rural areas, non-migrants from urban areas, rural-to-rural migrants, rural-to-urban migrants, urban-to-urban migrants, urban-to-rural migrants, total urban, and total rural.

Two additional criteria were employed to define our migration groups. Firstly, we selected women who had migrated before reaching the end of their reproductive age and had resided in their current location for more than five years. Recent migration was excluded from our analysis.

2.1 Cohort fertility rates

The completed cohort fertility rate ($CFR_t(x)$) expresses the lifetime fertility of women. It is a pure quantum measure and is well suited for comparisons because, unlike the total fertility rate, it is not impacted by changes in the timing of childbearing. It is obtained by dividing the total number of children ever born by women born in year t up to age x by the number of women in birth cohort x born in year t:

$$CFR_t(x) = \frac{Chborn_t(x)}{w_t(x)} \quad (1)$$

Where,

- $CFR_t(x)$: Cohort Fertility Rates for cohorts of women born in year t,
- $Chborn_t(x)$: Children Ever Born to cohorts of women born in time t,
- $w_t(x)$: Total number of women from the cohort born in time t.

Given that we are examining a cohort characterized by persistently high fertility rates, most childbirths occurred beyond 35 or even 40. When exclusively considering fertility as observed during the census, there exists the potential for distortion in comparing fertility differentials among various migrant groups. This is primarily due to the anticipation of higher fertility rates and, consequently, a more significant percentage of births occurring after age 35 within the rural non-migrant population compared to the urban non-migrant population. To address this concern, we employed a method for estimating completed fertility for cohorts aged below 40 at the time of the census. This method is based on the paired cohort comparison approach initially proposed by Brass and Juarez (1984) and subsequently utilized in the study conducted by Lerch (2019):

$$PPR(35-39, t+10) = PPR(40-44, t) * \prod_{c=40-44}^{45-49} \frac{PPR(c-5, t)}{PPR(c, t-5)} \quad (2)$$

The method involves a cohort truncated approach, using parity progression ratios (Moultrie et al., 2012; Brass-Juarez, 1983), which is the proportion of women who moved from birth order *i* that progressed to one more birth *i+1*. The method of BRASS and Juarez (1984) assumes that the fertility difference between adjacent cohorts is continuous and that there are no distortions after 30 years (Lerch, 2019).

2.2 Decomposition method

The theoretical framework of decomposition is based on the simple principle of breaking down demographic measures into components for a better understanding of a given study/problem. Despite simple mathematical methods, the method can explain the fundamental relationships between demographic variables (CANUDAS-ROMO, 2003). The decomposition method is used when comparing demographic variables that belong to different populations or when comparing variables within the same population over the years.

The origin of decomposition arises from the standardization method, a procedure to adjust crude rates to eliminate the effect of population composition (whether by age or another variable). Thus, it allows for comparing crude rates between two or more populations. If the populations under analysis do not have the same age structure, crude rates cannot be directly compared, which is why standardization is used (MATUDA, 2009).

According to Kitagawa (1955), little had been explored regarding the factors that explain the differences between standardized rates compared to differences between non-standardized rates. His idea was that if standardization alters the differences between two rates, there must be a way to measure the amount of such change and break it down into components attributable to factors. Thus, Kitagawa proposed a method to formalize the process of making inferences from standardized data and establish a technique for interpreting the differences brought about by standardization in terms of the factors involved (KITAGAWA, 1955). This is how the first decomposition method, which Kitagawa (1955) named "components of a difference between two rates," emerged.

2.2.1 Kitagawa (1955)

The objective of Kitagawa's method (1955) is to explain the difference between the total rates of two groups in terms of differences in their specific rates and differences in their composition. The method is based on the differences between the two measures, as indicated by the formula below:

$$R_2 - R_1 = \sum_{i=1}^{n}((P_{2i} - P_{1i}) * \frac{(R_{2i} + R_{1i})}{2}) + \sum_{i=1}^{n}((R_{2i} - R_{1i}) * \frac{(P_{2i} + P_{1i})}{2}), \qquad (1)$$

where:

- R_2 e R_1 = overall rate of populations 2 and 1;
- i = category of the predictor variable;
- P_{2i} e P_{1i} = proportion of population 2 and 1 in category I of the predictor;
- R_{2i} e R_{1i} = rate of population 2 and 1 in the predictor category.

According to Kitagawa's formulas (1955), the difference in crude rates is attributed to structural differences in predictor i and specific rates of the predictor (KITAGAWA, 1955; TIAN, 2018). In the case of this study, we applied Kitagawa's method (1955) to analyze the influence of changes in migratory composition and the rate effect, which would be the changes in other factors at the beginning of the fertility transition, allowing us to quantify differences in composition between two populations over time (TIAN, 2018).

2.2.2 Lazzari, Mogi and Canudas-Romo (2021)

We used decomposition to estimate the contribution of migration to fertility changes. The decomposition method quantifies the effect of migration on fertility levels by breaking down changes in complete cohort fertility rates into migration composition effect and rate effect (VAUPEL; CANUDAS-ROMO, 2003). In this study, the decomposition method used will be the one proposed by Lazzari, Mogi, and Canudas-Romo (2021). The mathematical formulas below were employed:

$$TFC\ (t) = \sum_{i=1}^{10+} \sum_{e=M1}^{M6} \frac{NV_i^e(t)}{M(t)} \quad (2)$$

$$TFC\ (t) = \sum_{i=1}^{10+} \sum_{e=M1}^{M6} M^e(t)F_i^e(t) \quad (3)$$

Where, $M^e(t)$ corresponds to migratory composition, i.e., the proportion of women from each migratory group among all women. And $F_i^e(t)$ corresponds to specific birth rates (birth rate i for women from a migratory group among all women). Equation 2 was reformulated using live births from mothers among the migratory groups (M1 = non-rural migrants; M2 = non-urban migrants; ...). Equation 2 can be decomposed into the migratory and rate effects, as in Equation 3. The partial derivative allows for the decomposition of Equation 4 to quantify changes in migratory composition effect and rate effect, as seen in Equation 4. The decomposition method identifies the migratory composition effect (E) and the migratory-specific fertility by birth rate. To quantify the effects of changes, Equation 4 will be decomposed from the partial derivative:

$$TFC\ (t) = \sum_{i=1}^{10+} \sum_{e=M1}^{M6} [M^e(t)F_i^e(t) + [M^e(t)F_i^e(t)]\ , \quad (4)$$

The decline in cohort fertility can be explained by the decrease in birth progressions from the third child onward. Therefore, decomposing by birth progression brings another important component to understanding the decline in cohort fertility rates because it shows the exact percentage contribution to specific effects. Thus, the method unveils the contributions of migratory composition and fertility behavior to changes in the cohort fertility rate among women born between 1921-1945.

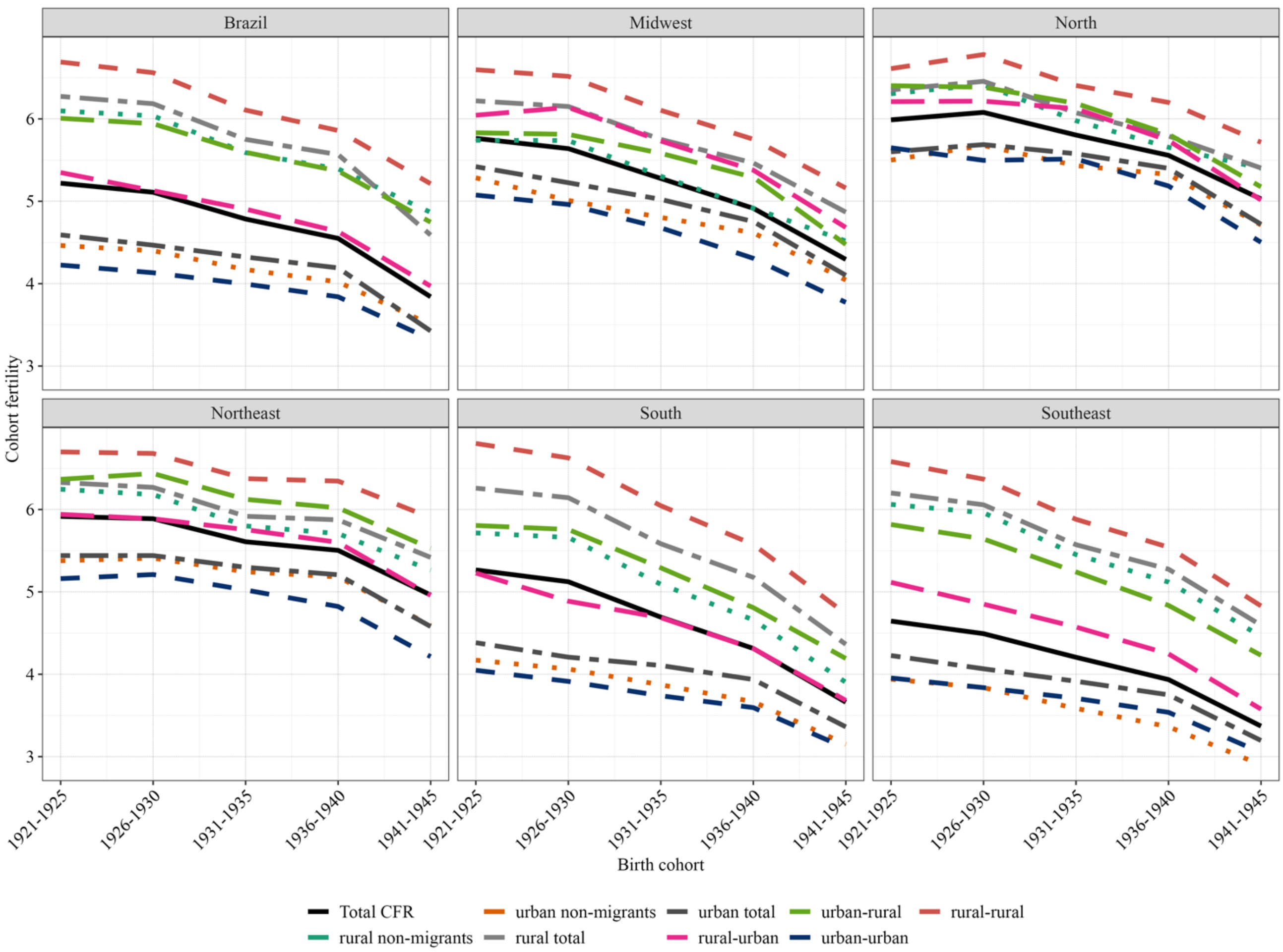
3 Preliminary results

We found a reduction in fertility differentials by migratory status. However, this reduction varied between regions. The Southeast and South regions showed the highest fertility differentials but decreased over the years. On the other hand, the North and Northeast regions had more similar cohort fertility rates, and their fertility differentials increased over the years. A plausible explanation for this increase could be related to urban fertility declining more rapidly than rural fertility, as the urbanization process in Brazil was heterogeneous (VERGOLINO; DANTAS, 2005) or a more substantial effect of migration in these two regions. However, the indirect impact of migration on fertility also depends on the level of urbanization in each area, i.e., a high level of urbanization reduces the proportion of migrant population among household situations (LERCH, 2018b). In Brazil, the urbanization process partly explains the fertility differentials in this study. The Southeast and South were the most urbanized regions, with Minas Gerais and São Paulo states standing out due to rural exodus (MARTINE, 1994). This may be why fertility differentials among types of migrants are more evident in these regions.

These results found possible selectivity; for example, women who stayed in rural areas had lower fertility than rural migrants to another rural or urban location. This may suggest the selectivity hypothesis, possibly due to the decision to migrate, meaning migrants are self-selected at the origin and are part of a non-random sample (MAJELANTLE; NAVANEETHAM, 2013). Ribe and Schultz (1980) state that migrants with a preference for fewer children tend to move to urban areas, while migrants with a preference for larger families choose rural areas, destinations that favor their behavior patterns. Furthermore, urban women who migrated to rural areas have a higher fertility rate than those who did not migrate (rural areas) or made the migratory move between urban areas. Again, this behavior may be linked to selectivity. According to Lee (1966), migrants constitute a population with individual and specific characteristics, not a random sample from the region of origin, responding differently to various factors and stimuli at the origin and destination. Thus, it would be inevitable not to have migratory selectivity (LEE, 1966).

Figure 1 shows the results of complete cohort fertility rates for rural/urban areas by migratory group. In Figure 1, it can be seen that after the birth cohort of 1935, fertility differentials were reduced for all groups. This finding is consistent with the fact that it was a landmark year for the fertility transition in Brazil. Additionally, the results show that migration could impact the reproductive behavior of a region, delaying or accelerating fertility decline. Initially, migration can postpone fertility decline, and after a period of residence at the destination, they may assimilate the reproductive behavior of natives. Thus, migration appears to be a factor in delaying fertility (GOLDSTEIN; GOLDSTEIN, 1981).

FIGURE 1 - Cohort Fertility rates from in-migrants and non-migrants, Brazil and regions, births cohorts 1921-1945



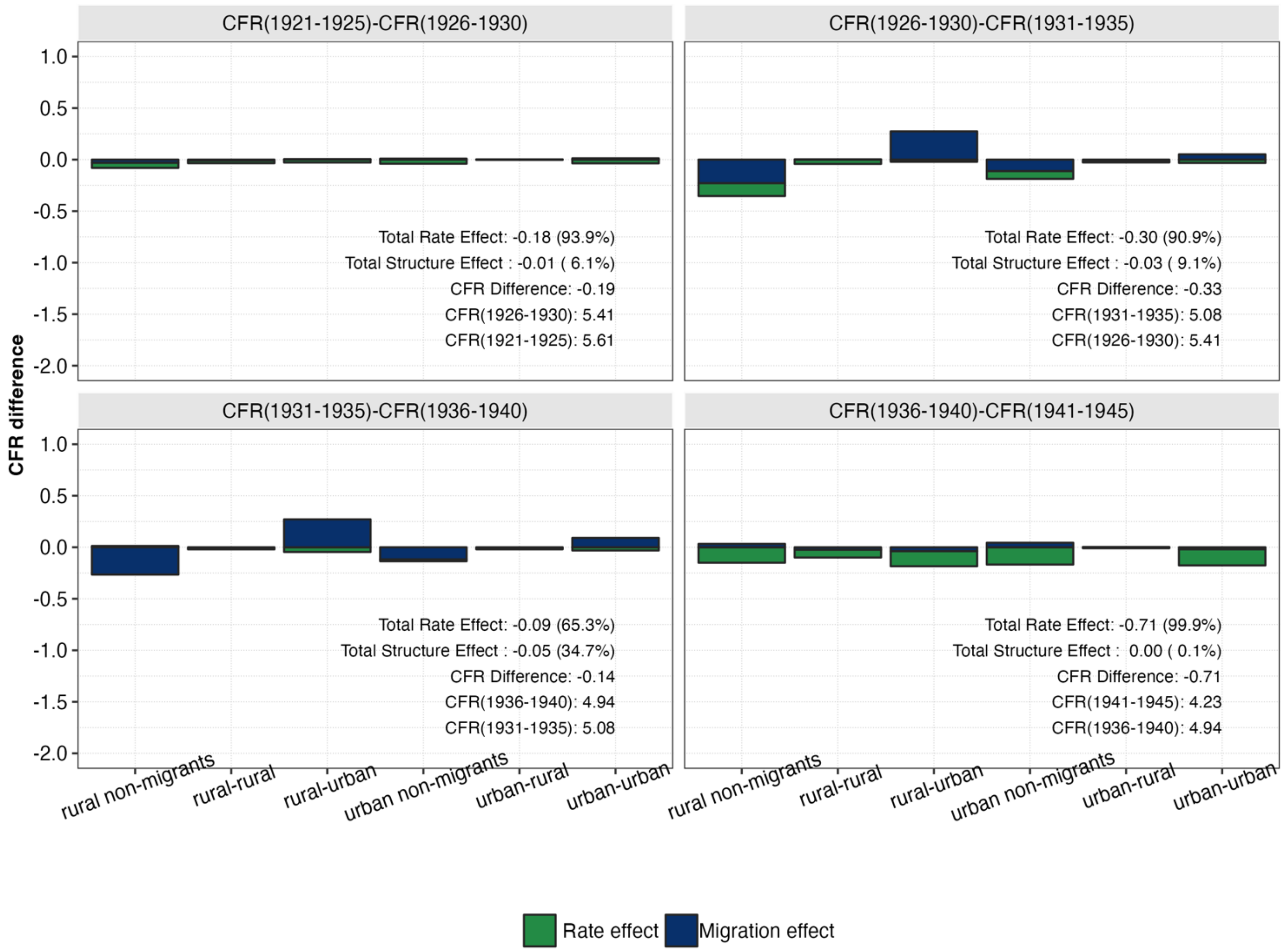
Source: Authors' calculations using Brazilian Population Censuses 1970 and 1980 data. Minnesota Population Center (2020)

3.1 Kitagawa decomposition (1955)

Figure 2 presents the results of the decomposition of CCFs for women born between 1921 and 1945 according to migratory groups for Brazil, Midwest, North and Northeast (Figure 3), South, and Southeast (Figure 4). We compared birth cohorts: 1921-1925 versus 1926-1930, 1926-1930 versus 1931-1935, 1931-1935 versus 1936-1940, 1936-1940 versus 1941-1945. The figure above shows that the differences between CCFs decreased over the years. The results for Brazilian regions followed the same pattern as Brazil. The cohorts with a migratory composition effect were higher when comparing cohorts 1926-1930 versus 1931-1935 and 1931-35 versus 1936-1940. A plausible explanation may be linked to the fact that these cohorts were in the midst of the transition and urbanization process, meaning they were directly affected by both methods. Meanwhile, the first cohort, still at the beginning of the process, may not have been affected. The older cohorts were already in an advanced stage of urbanization, where migrating from rural to urban areas did not influence fertility.

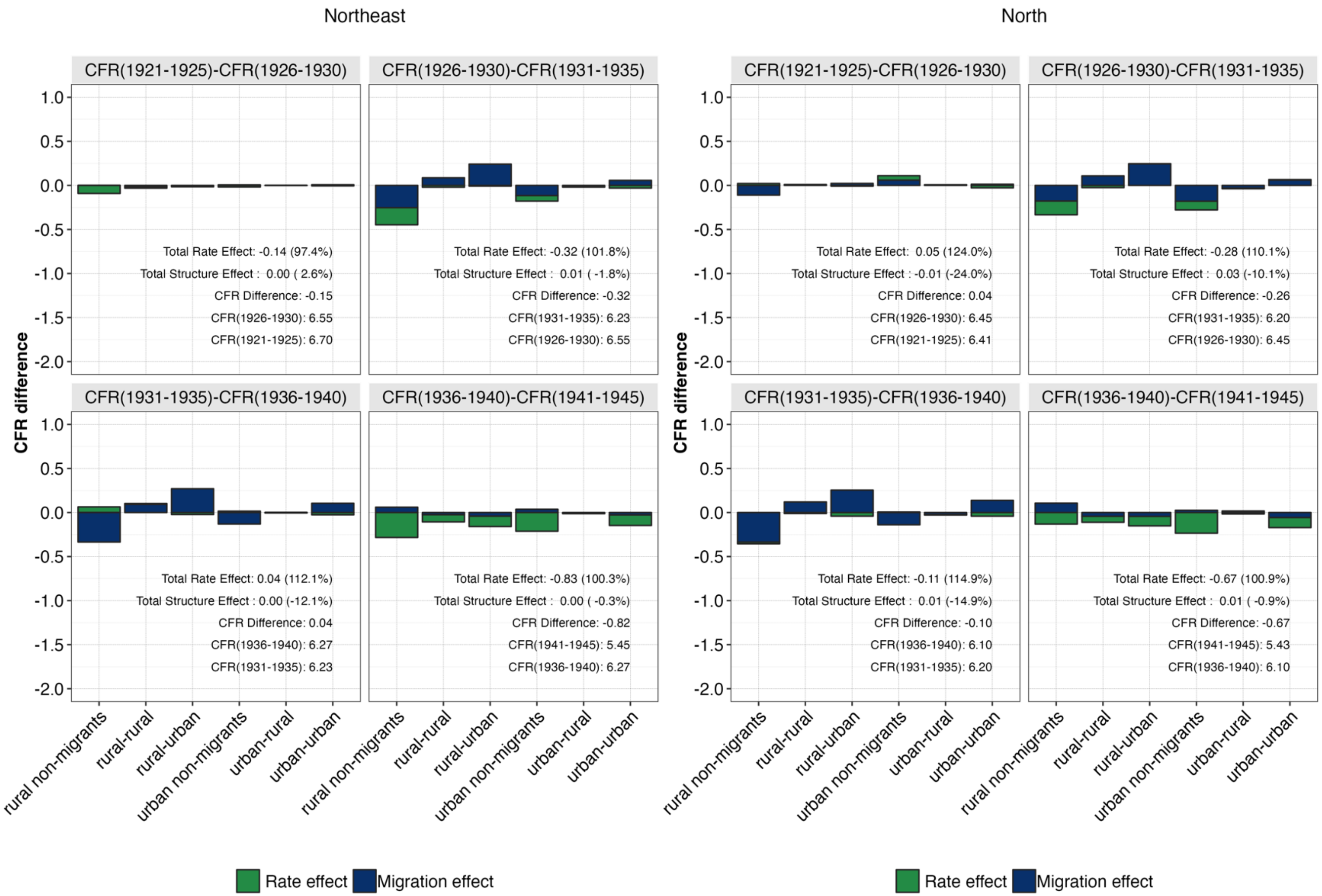
Most of the reduction in CCFs in Brazil and regions was driven by the rate effect, with the remaining effect being due to migratory composition. We know that Brazil's fertility rate decline was associated with structural, social, and economic factors. The educational level also plays an important role in fertility decline; however, in the case of the birth cohorts studied here, it did not make much difference. Over 90% of our sample had less than primary education.

FIGURE 2 – Kitagawa Decomposition of the change over time in completed cohort fertility of women born in 1921-1945 – Brazil



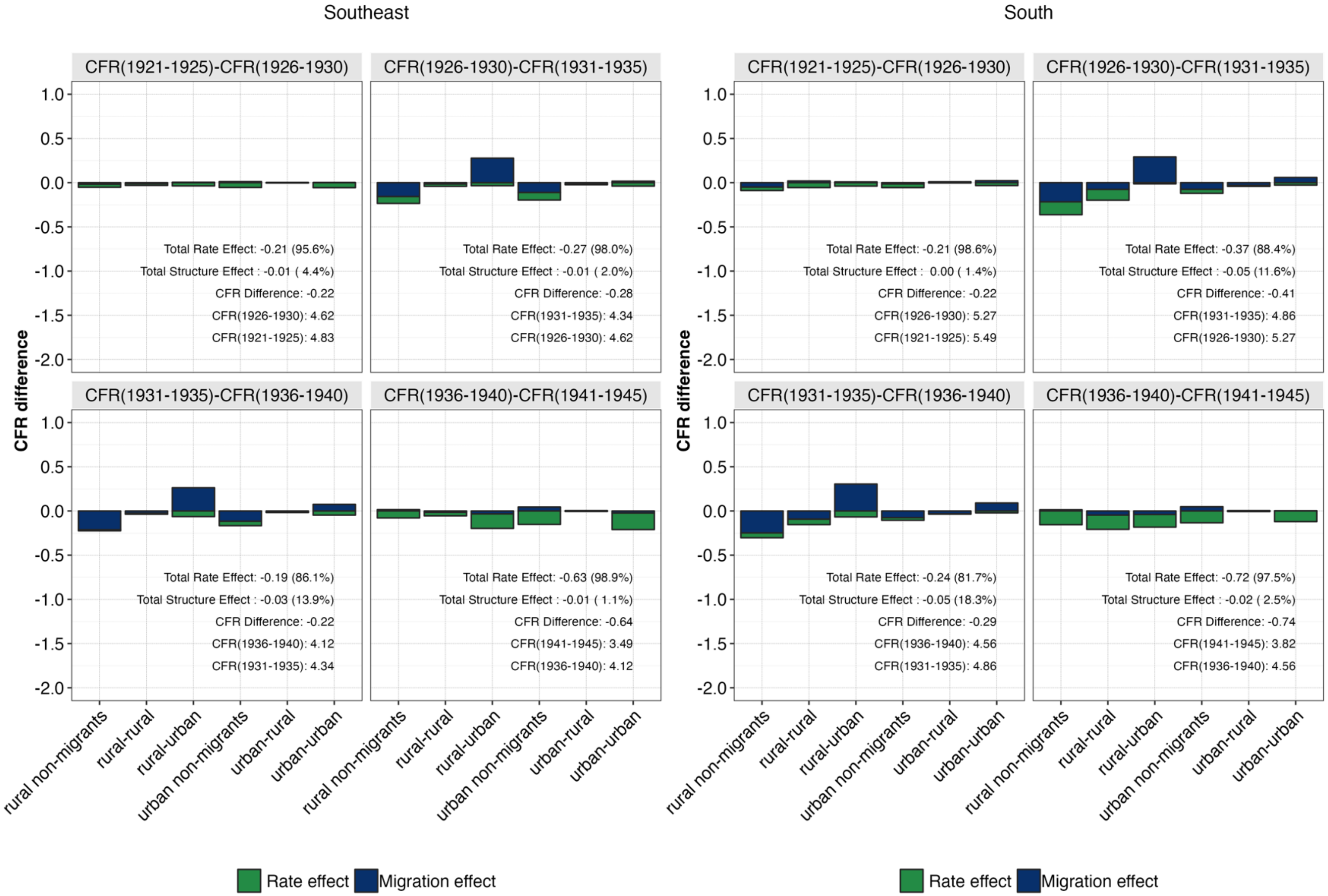
Source: Authors' calculations using Brazilian Population Censuses 1970 and 1980 data. Minnesota Population Center (2020). Notes: All values are multiplied by 100

FIGURE 3 – Kitagawa Decomposition of the change over time in completed cohort fertility of women born in 1921-1945 – North and Northeast



Source: Authors' calculations using Brazilian Population Censuses 1970 and 1980 data. Minnesota Population Center (2020

FIGURE 4 – Kitagawa Decomposition of the change over time in completed cohort fertility of women born in 1921-1945 – South and Southeast



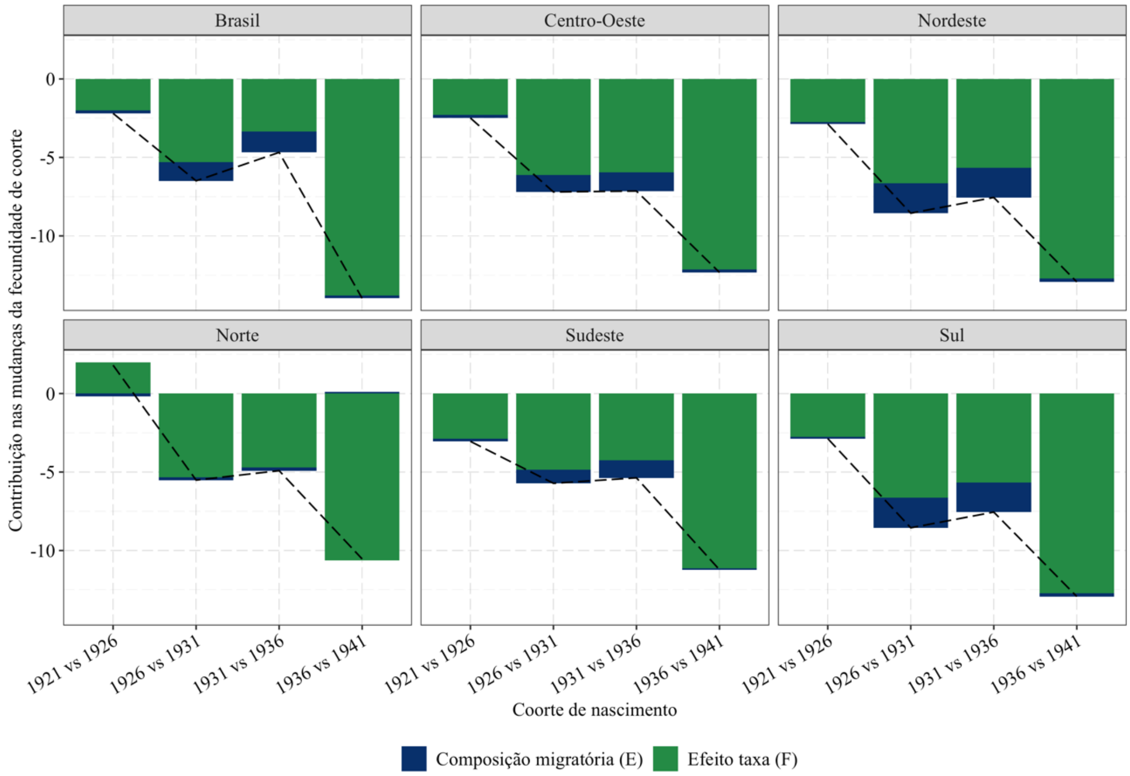
Source: Authors' calculations using Brazilian Population Censuses 1970 and 1980 data. Minnesota Population Center (2020)

3.2 Decomposition of Lazzari, Mogi, and Canudas-Romo (2021)

Figure 5 shows the results of the decomposition of changes in CCFs between birth cohorts. The effect size corresponds to the difference in CCFs between the two cohorts. In cohorts 1926-1930 compared to 1931-1936, CCFs decreased by 0.23 children per woman in the Northeast. 30% of this 0.23 difference is due to the migration effect, and the remaining 70% of the decline is explained by other behavioral changes (the rate effect) unrelated to urban-to-rural migration. For the North region, the values were very close to those of the Northeast.

In the case of the Southeast, the decline was 0.26 children per woman. The migration effect (E) was 40%, meaning 40% of the 0.26 is explained by the migration effect. For Brazil, the results are very similar to those of the Southeast. As in Kitagawa's decomposition (1955), the results showed that only the birth cohorts of 1926-1930, 1931-1935, and 1936-1940 had some migratory effect. Women from the birth cohorts of 1921-1925, at the beginning of the fertility transition, were already at the end of their reproductive cycles, and the migration process did not affect their reproductive behavior. Since fertility was high in all regions and social strata, migrating did not expose these women to different reproductive behaviors than their regions of origin. Thus, migration appears to be just the beginning of change, cohorts from 1926 versus 1931. The migratory effect disappears when comparing the younger cohorts, and behavioral change is the dominant factor in fertility decline.

FIGURE 5 – Decomposition of the change over time in completed cohort fertility of women born in 1921-1945 – Brazil and regions



Source: Authors' calculations using Brazilian Population Censuses 1970 and 1980 data. Minnesota Population Center (2020). Notes: All values are multiplied by 100

4 Discussion

This study aimed to contribute to the discussion on the relationship between migration and fertility among rural-to-urban migrant women in Brazil and its regions, focusing on the early stages of the Fertility Transition. The main was to analyze whether migration had a positive or negative impact on the pace of the transition and to quantify this contribution. Some scholars have examined this relationship, but often in a particular context, such as a single city or region, typically in the Northeast. After reviewing some of these studies, we identified these gaps. We provided a more comprehensive perspective on this relationship, encompassing Brazil and its regions, focusing on migration and the Fertility Transition process.

To understand whether there are fertility differentials among rural and urban migrant women, we used a cohort fertility and decomposition approach. To do this, we compared cohort fertility rates between migratory groups. We used variables representing previous and current household situations from the 1970 and 1980 censuses to select these groups. The chosen definition for migrants was women who migrated more than five years ago, before age 40, and between rural and urban areas. With this definition, we excluded more recent migrants and women who migrated after completing their reproductive cycle. Thus, we selected six groups: non-rural non-migrants, non-urban non-migrants, rural-rural migrants, rural-urban migrants, urban-rural migrants, and urban-urban migrants.

We notice that the groups have fertility levels closer to their destination when looking at each migratory group. Women who migrated from urban to rural areas had fertility rates similar to non-migrant rural women. The same applies to rural-to-urban migrants, meaning they had fertility rates closer to those of non-migrant urban women. These results may suggest proximity to the adaptation and/or selectivity hypotheses. Similar to Lerch's work (2019a), we hypothesized that the fertility of migrants would fall between the rates of the destination and origin. For example, rural-to-urban migrants had slightly higher fertility than non-migrant urban women but lower than non-migrant rural women.

With the analysis of cohort fertility rates, we indeed observe fertility differentials among migratory groups. Therefore, in the third part of the thesis, we discussed the decomposition method by Kitagawa (1955) and by Lazzari, Mogi, and Canudas-Romo (2021) to determine the extent of migration's contribution to fertility. Both approaches aim to separate the effects of migration and the rate effect, which encompasses all other variables. The results of both decompositions showed a contribution of the structural impact of migration of 30% in the Lazzari, Mogi, and Canudas-Romo (2021) method and 34% in the Kitagawa (1955) method. The migratory effect was more significant when comparing the birth cohorts of 1926-1930 with 1931-1935 and 1931-1935 with 1936-1940. The most significant contribution for all Brazilian regions came from the groups of migrants from rural to urban areas with a positive effect. From this result, the migration of women between rural and urban areas may have slowed down the Fertility Transition process, decelerating its rate of decline. In other words, the fertility decline might have been more significant and faster in a scenario where women had not migrated from rural to urban areas.

We encountered several limitations throughout the research, primarily related to the available data. The first limitation was that we could not reconstruct the entire migratory history of women, only part of it. With the available variables, we do not know the exact age of the last migratory movement or identify the residential situation in childhood. The second limitation is that we do not know if the woman had a child before or after migrating. We tried to mitigate this limitation by selecting women who migrated before completing their reproductive age, but the problem still needs to be solved. The third limitation is the compatibility between censuses. We used the 1970 and 1980 censuses but could not perform the same analysis with the 1991, 2000, and 2010 censuses because they had different questions we used in the other two censuses. Of course, the 1970 and 1980 censuses are crucial for this thesis since our goal is to understand the beginning of the fertility transition. However, the analysis could be more comprehensive if we could track these cohorts throughout the transition.

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