The Impact of Migration on Total Fertility Rate in the European Union Member States

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EC 360 – Econometrics

Final Project Report

3 December 2024

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Introduction

Our research is focused on the effect of the migrant population on the total fertility rate in the countries. We decided to focus on the EU countries in the period from 2014 to 2023 to uncover this relationship. While we do have data that spans over ten years, our research is not focused on the effect of time on the total fertility rate and instead explores the effect of migration on the total fertility rate of a country. However, we also considered the effect of trend in our analysis.

Previous Literature

In the previous literature found in the research conducted, there has been research done on how migrants can affect variables such as gross domestic product and unemployment rates of a country. Some interesting information that was helpful in understanding some of the relationships between migration and fertility rates of countries were discussed in *Multiple Origins and Multiple Destinations: The Fertility of Immigrant Women in Europe*, where the text dove into how immigrant women tend to assimilate into the culture of their destination countries, even when it comes to how many kids they are having, which could suggest that immigrant women have fewer children than the women living in their country of origin.

Another piece of literature that laid a basis for the research conducted here was *Migration into the EU: Stocktaking of Recent Developments and Macroeconomic Implications*. This work focused on the interaction between migration into EU countries and a variety of macroeconomic variables, including but not limited to GDP, which is a variable that is included in this research. This research gave us insights on the effects of migration on some of these variables, and we wanted to include migration but as a determinant of how the total fertility rate is affected by migration alongside other macroeconomic variables.

A motivating factor for this research is the previous literature, which explored several different effects that migration has on a country's economy and demographics. In particular, one titled "The Effect of Immigration on Unemployment in Europe: Does the Core-Periphery Dualism Matter?" explores the impact of migration on unemployment in several EU countries and it found that migration can help lower unemployment and pose the opportunity for growth in many of the EU countries. From this finding, we wanted to investigate how migration into the EU could be beneficial in terms of improving the dismal birthrate that many developed countries must deal with as their populations age out of the workforce, life expectancies increase, and the amount of people dependent on welfare that comes from taxpayer money increases.

Why is it relevant

This research aims to uncover whether the percentage of migrants in a country affects the population growth in that country. Understanding this relationship would help policymakers predict future population trends, including aging populations or potential labor shortages. If migrants tend to have higher fertility rates, this could help balance a declining native-born fertility rate, potentially reducing the long-term strain on pension systems and other welfare programs. Understanding the effect of migration on the TFR could help policymakers impose regulations that will lead to higher economic productivity in the long run. While focusing on the GDP and economic situation in a country can be helpful to determine a short-term effect of migration on the domestic economy, focusing on the fertility rate can uncover some long-lasting effects. Additionally, understanding how a country's total fertility rate varies with migrant inflows can help policymakers decide whether to prioritize social projects targeting the younger or older population. This research can, therefore, provide useful insights for long-term economic and social planning.

Assumptions

Our assumption is that the total fertility rate in a country is higher if that country has a higher percentage of migrant population. We based our assumption on the cultural and socioeconomic differences in fertility patterns: family sizes tend to be larger in many migrant communities compared to the native population of the EU countries.

For the relationship between GDP per capita and the Total Fertility Rate, our assumption is that the total fertility rate will be lower in a country with a higher GDP per capita, as increased economic development is often associated with better access to education, greater career opportunities for women, and a shift towards smaller family sizes.

Our assumption is that the total fertility rate will be lower in a country with higher price levels, as increased costs of living can discourage larger family sizes due to the financial burden that additional family members would create.

Our assumption is that the total fertility rate will be lower in a country with a larger population, as densely populated areas often have higher living costs and greater urbanization, which leads to smaller family sizes.

Our assumption is that the total fert ility rate is lower in countries with a higher employment rate of women, as women who are in the labor force have less time to spend with their children and families, possibly reducing the fertility rate.

Lastly, our assumption is that the total fertility rate is lower in countries with higher education levels of women, as better access to education often shifts priorities from traditional family values to career development and personal growth.

Our Variables

The dependent variable in our analysis is the Total Fertility Rate in each European Union country, spanning from 2014 until 2023. This variable tells us on average, how many children each woman is having in these counties, including both migrant women and native women in these countries.

From our standard linear regression model, we investigated how to improve the performance of our model. The first thing we did was take the natural logarithm of the variable Migrants, which represents the percentage of the total population in a country that is made up of foreign-born persons, and create a new variable, called lnMig. But implementing this variable into the new model did not prove to be beneficial to improving its performance, so we decided to use the original variable. However, this would be an interesting factor to consider in further analysis, as the relationship between the total fertility rate and the percentage of migrants in a country appears to be nonlinear. Taking the natural logarithm of the variable Population (total number of people in each country each year from 2014-2023) improved the performance of the model. The scatter plot in Figure 3.1.1 shows that the relationship between the population of a country and the total fertility rate is non-linear, which is also a reason why taking the natural logarithm of this variable was a way of improving our model.

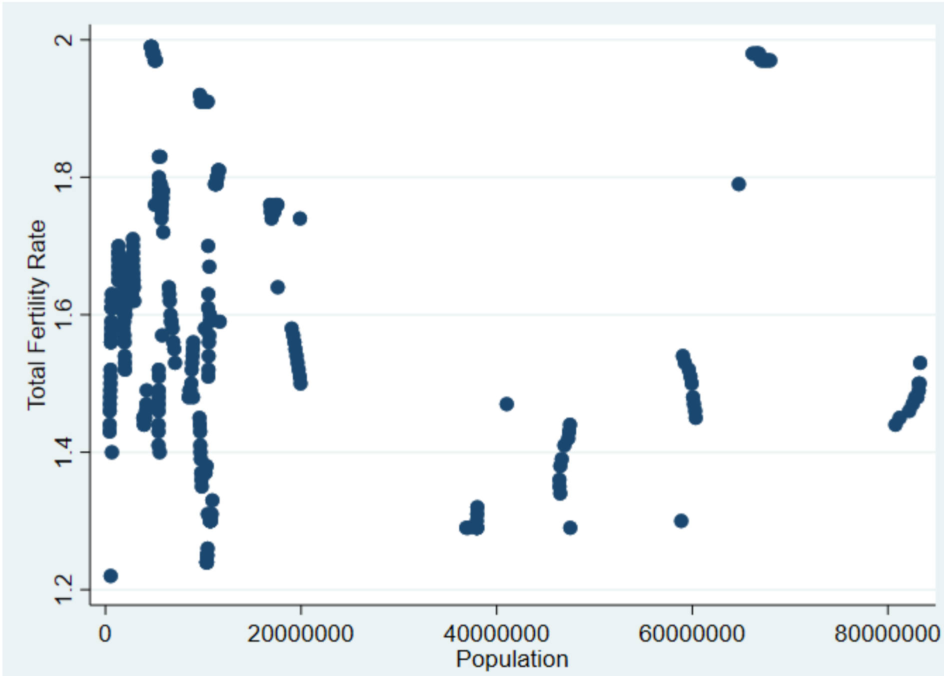

Figure 3.1.1: Scatter Plot of the Total Fertility Rate over the Population

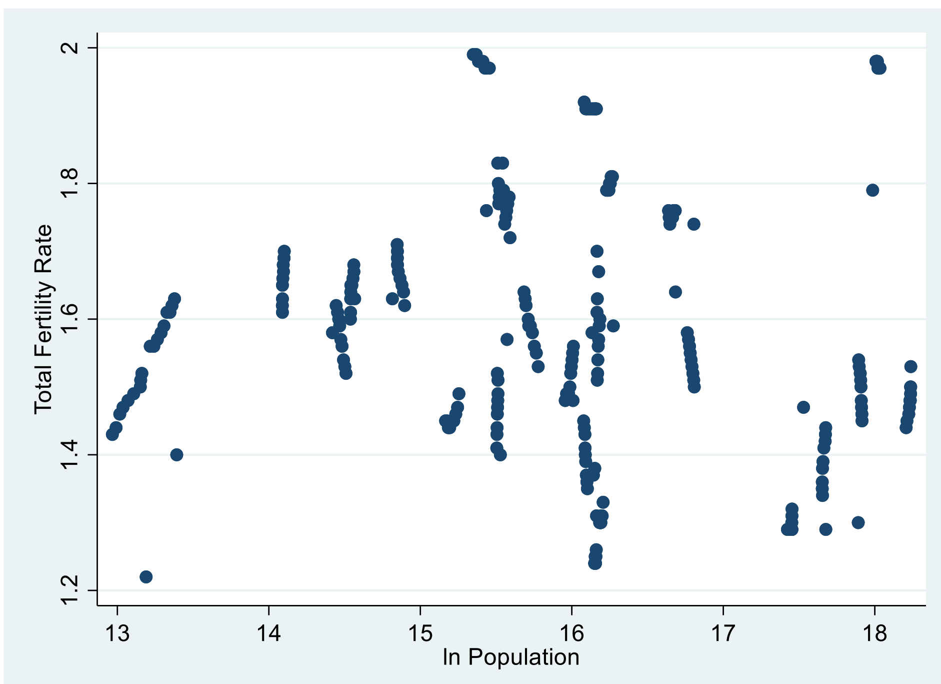

Figure 3.1.2: Scatter plot of the Total Fertility Rate over the ln of Popualtion

Since the distribution of our modified independent variable (as shown in Figure 3.1.2) is more even with smaller gaps between observations, as well as the variable (lnPop) is statistically significant at 5% level of significance, we decided to keep this new variable in our improved model.

The last variable that we decided to transform was the variable for the employment rate of women. The relationship between Total Fertility Rate and the female employment rate seems to exhibit a non-linear trend. Therefore, we decided to transform this variable into Employment Rate of each country squared. This new variable proved to be statistically significant at one percent level of significance, versus the original Employment Rate on its own, which was only significant at ten percent level of significance.

The remaining variables in the dataset are GDP Per Capita, Price Levels, Education Levels of women in each country, and a binary variable for northern European countries. The Education Levels variable is a variable that shows the percentage of people in each country with upper secondary, post-secondary non-tertiary and tertiary education attainment level.

GDP per capita proved to have the issue of multicollinearity with both the variable Migrants and the variable Price Levels, as migrants tend to look to moving into countries with higher GDP, so this variable was not included in our final regression output. This is shown in table 3.2 below, a correlation matrix between all independent variables.

Table 3.2 – Correlation Matrix

```
. corr Migrants GDPPerCapita Population PriceLevels EducationLevels UnemploymentRate
(obs=260)

             | Migrants GDPPer~a Popula~n PriceL~s Educat~s Unempl~e
-------------+------------------------------------------------------
    Migrants |   1.0000
GDPPerCapita |   0.7919   1.0000
  Population |  -0.0989   0.0108   1.0000
 PriceLevels |   0.6012   0.8727   0.0746   1.0000
EducationL~s |  -0.2142  -0.1109  -0.2229  -0.1784   1.0000
Unemployme~e |  -0.0577  -0.1682   0.1025  -0.0434  -0.3825   1.0000
```

However, we wanted to make sure that we were still accounting for the countries which have a higher GDP per capita, so we decided to create a new dummy variable called "Good Economy." This variable was assigned the value one for all countries with a GDP per capita above thirty thousand euros, since the mean was around twenty-seven thousand euros. Lastly, one other variable added was a dummy variable that took the value one if the country is in the north of Europe called North.

Price Levels is a variable that measures the comparative price levels across the European Union countries represented in the dataset. Ultimately, this variable, as shown in Figure 3.3, has a somewhat linear relationship with Total Fertility Rate and proved to be statistically significant at 1% level of significance, so this variable was left in its original state.

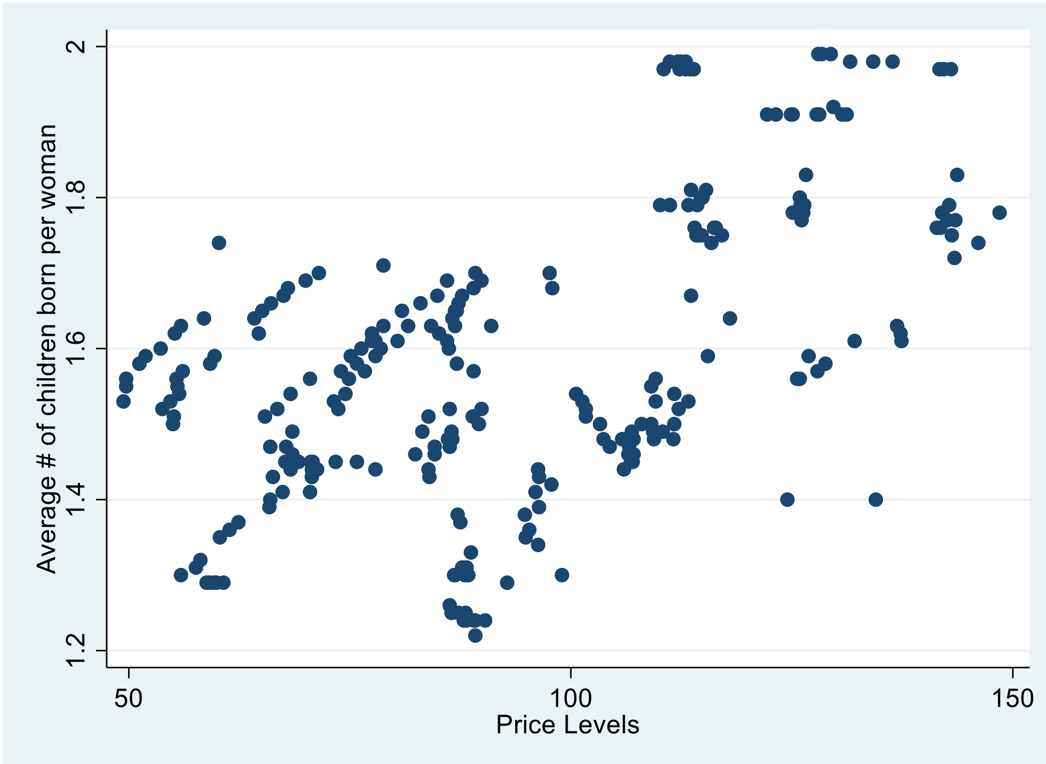

Figure 3.3: Scatter plot of the Total Fertility Rate over Price Levels

Therefore, we determined that the best course of action was to include the natural logarithm of the variable Population, and the Employment Rate Squared in the second linear regression in place of the original versions of these two variables. We dropped the GDP per Capita variable but used the dummy variable "GoodEconomy" in place of it, and variables Migrants, Price Levels, and Education Levels are not transformed, but used in their original forms.

Our analysis

Our model shows a negative average association between the total fertility rate in a country and the percentage of migrants in that country. This is shown in Table 4.1, which was our final regression outputs. In this model, we can see that every variable was statistically significant when alpha is set to five percent, and nearly all are also significant at one percent level of significance.

Table 4.1 – Final Regression Output 1

```
. reg TotalFertilityRate Migrants lnPop PriceLevels EducF EmpF EmpFsquared i.north i.GoodEconomy
```

Source	SS	df	MS			
				Number of obs	=	234
				F(8, 225)	=	39.68
Model	5.07037566	8	.633796957	Prob > F	=	0.0000
Residual	3.5937628	225	.015972279	R-squared	=	0.5852
				Adj R-squared	=	0.5705
Total	8.66413846	233	.037185144	Root MSE	=	.12638

TotalFertil~e	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
Migrants	-.0084512	.0014589	-5.79	0.000	-.011326	-.0055764
lnPop	-.032727	.0087027	-3.76	0.000	-.0498761	-.0155778
PriceLevels	.0035568	.0007743	4.59	0.000	.002031	.0050826
EducF	.0073896	.001481	4.99	0.000	.0044713	.010308
EmpF	.0353702	.0169175	2.09	0.038	.0020333	.0687071
EmpFsquared	-.0002722	.0001301	-2.09	0.038	-.0005287	-.0000158
1.north	-.0723235	.0302342	-2.39	0.018	-.131902	-.012745
1.GoodEconomy	.2132479	.0413821	5.15	0.000	.1317019	.294794
_cons	.1358645	.6453648	0.21	0.833	-1.135868	1.407597

In this regression, when a country has a GDP per capita higher than thirty thousand euros, the total fertility rate increases by .213 on average compared to the countries with lower GDP per capita, signifying the positive relationship between the two variables. Price levels and education levels of women also have a positive effect on the total fertility rate, meaning as they increase, the fertility rate also increases. With the variable for employment rate, this is slightly different, as for low values, there tends to be an increase in total fertility rate but at higher values, the quadratic term has more effect on the total fertility rate than the linear term, suggesting that that at higher levels of female employment in a country, this positive relationship becomes weaker. While some of these findings were expected, such as the relationship with employment levels of women and total fertility rate, others were not as expected, such as the negative relationship between migrants and total fertility rate, as well as the positive relationship between price levels and total fertility rate.

We decided to further explore the negative average association between the total fertility rate in a country and the percentage of migrants in that country. Since we are working with a panel dataset and our observations are from different periods, there might be a trend in our data that causes a spurious correlation between our dependent and independent variables. In fact, in the ten years we are observing, the percentage of migrants in these countries has been rising. We have checked this by regressing the percentage of migrants against the years, which is shown in table 4.2

Table 4.2 – regression of migrants on year

```
. reg Migrants Year

      Source |       SS           df       MS      Number of obs   =       260
-------------+----------------------------------   F(1, 258)       =      3.91
       Model |  308.257993         1  308.257993   Prob > F        =    0.0490
    Residual |  20334.9342       258  78.8175744   R-squared       =    0.0149
-------------+----------------------------------   Adj R-squared   =    0.0111
       Total |  20643.1922       259  79.7034447   Root MSE        =    8.8779

------------------------------------------------------------------------------
    Migrants |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        Year |    .379091   .1916893     1.98   0.049     .0016162    .7565659
       _cons |  -752.5863   386.9253    -1.95   0.053     -1514.52    9.347436
------------------------------------------------------------------------------
```

The model shows that on average as the year increases by one, holding everything else constant, the percentage of migrants in a country increases by 0.37 points.

Total fertility rates, on the other hand, are known to be falling in most of the EU countries. Therefore, the negative average association between our variables that our previous model displayed may be caused by a trend. We decided to try to remove this issue by taking the first difference of the total fertility rate, as well as the percentage of migrants. As we do not have observations for the year 2013 in our dataset, the difference cannot be calculated for the year 2014, so we dropped the observations for year 2014 (because of the issue with missing variables).

Next, we ran a regression using the difference in the total fertility rates as our dependent variable and the difference in the percentage of migrants as our independent variable. As for the control variables, we included price levels, the employment rate for women, the squared employment rate for women, women's education levels, a dummy variable indicating whether a country is in Northern Europe, a dummy variable indicating whether a country has a strong economy, and the natural logarithm of the population.

```
. reg dTFR dMigrants lnPop PriceLevels EducF EmpF EmpFsquared i.north i.GoodEconomy

      Source |       SS           df       MS      Number of obs   =       234
-------------+----------------------------------   F(8, 225)       =      5.79
       Model |  .123570327         8  .015446291   Prob > F        =    0.0000
    Residual |  .600295049       225  .002667978   R-squared       =    0.1707
-------------+----------------------------------   Adj R-squared   =    0.1412
       Total |  .723865376       233  .003106718   Root MSE        =    .05165

------------------------------------------------------------------------------
        dTFR |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
   dMigrants |    -.02693   .0054454    -4.95   0.000    -.0376605   -.0161995
       lnPop |  -.0009318   .0030031    -0.31   0.757    -.0068495     .004986
 PriceLevels |  -.0002729   .0003089    -0.88   0.378    -.0008817    .0003359
       EducF |   -.001286   .0006116    -2.10   0.037    -.0024911   -.0000808
        EmpF |   .0083035    .006898     1.20   0.230    -.0052896    .0218965
 EmpFsquared |  -.0000631    .000053    -1.19   0.235    -.0001676    .0000413
     1.north |   .0221354   .0123535     1.79   0.075     -.002208    .0464789
1.GoodEconomy|  -.0181905    .016492    -1.10   0.271    -.0506891     .014308
       _cons |  -.1279749   .2626126    -0.49   0.627    -.6454696    .3895199
------------------------------------------------------------------------------
```

This model, just as the previous one, suggests an inverse relationship between the total fertility rate and the percentage of migrants. On average, the total fertility rate changes by 0.0269 units less when the percentage of migrants in a country changes by one more unit. However, the model has an R-squared of only 0.1707. While all our variables remain statistically significant, the model overall fails to explain much of the variation in the dependent variable. Despite this, the model still indicates a negative relationship between the percentage of migrants and the total fertility rate, consistent with what we observed in our previous analysis.

Potential flaws

A potential flaw of our analysis is the omission of variables that could affect our dependent or independent variables. These may include, among others, government policies, the healthcare system, housing market conditions, and environmental factors. By including these variables in further analysis, we could avoid the risk of omitted variable bias and enhance the reliability of our results.

Another limitation of our analysis is the geographic and time constraints, as we focused only on the EU countries from 2014 to 2023. Consequently, this analysis does not provide a universal conclusion but rather offers insights specific to this region and period.

Finally, while this analysis is based on highly relevant data from official sources, it does not account for undocumented immigrants, who might also affect the results and introduce additional complexities to the analysis.

Policy Implications

People may have fewer children due to the perceived or actual high costs of raising a family, especially in an unfamiliar country. Family-friendly policies that alleviate some of these costs could encourage higher fertility rates. Furthermore, other economic factors can influence the decision of people to have fewer children. Some of them include lack of job security and unemployment. Economic stabilization measures would benefit both the domestic and migrant population. An affordable and effective healthcare system is another factor that might encourage higher fertility rates. Policies aimed at reducing the cost of health services could positively affect the number of children born per woman. In conclusion, policies such as paid parental leave, subsidized childcare, and affordable housing programs could help reduce financial stress, making it easier for families to have more children.

Another way in which policymakers can positively affect the total fertility rate in a country is by focusing on the migrant population and creating social support programs that will encourage the migrants to have more children. This can be achieved by creating language learning programs and greater access to education for the migrant population. Policymakers could also adjust immigration policies to attract families who are more likely to have children. This could involve targeting countries with higher fertility rates for migration programs.