Immigrant Supply of Marketable Child Care and Native Fertility in Italy[¤]

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Abstract

The availability of child-care services has often been advocated as one of the instruments to counter the fertility decline observed in many high-income countries. In the recent past large inflows of low-skilled migrants have substantially increased the supply of child-care services. In this paper we examine if immigration as actually affected fertility exploiting the natural experiment occurred in Italy in 2007, when a large inflow of migrants – many of them specialized in the supply of child care – arrived unexpectedly. With a difference-in-differences method, we show that immigrant female workers have increased native births by a number that ranges roughly from 2 to 4 per cent. We validate our result by the implementation of an instrumental variable approach and several robustness tests, all concluding that the increase in the supply of child-care services by immigrant women has positively affected native fertility.

Keywords: Household Economics, Fertility, Immigrant Labour, International Migration

JEL codes: D12, F22, J13, J61

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1. Introduction

The decline in fertility rates has been at the centre of both researchers and policy makers' attention. The implications of a fertility rate below the reproduction rate are well known and this has stimulated a large debate about its causes and, especially, about the possible policy interventions.

Recent immigration waves have substantially increased the (potential) supply of child-care services, as many of the low-skilled immigrant women specialize in the provision of domestic services. The possible role of immigration in contrasting the negative trend in fertility and, more in general, in affecting women's time allocation between work and domestic activities has been discussed in very few papers, which we review in what follows.

Search for a provider of domestic services, especially for child rearing, might be complex and likely to generate frictions in the market, leaving potential matches unrealized. The increase in the presence of immigrants might improve the "stance" of the market and help additional vacancies to be filled. The large inflow of migrants might also reduce the reservation wage in the sector of domestic services inducing a further expansion of employment. Increased employment and, possibly, lower wages might reduce the cost of rearing children and thus affect fertility. If parents care about both the number and the "quality" of their offspring the impact of a reduction in the cost of children on fertility is ambiguous, as both can be affected by the cost of child rearing.

From a theoretical point of view, domestic services performed by non-household members can complement and/or substitute for parental time in the provision of the services necessary for child rearing. They can, therefore, affect the cost of children and parents' (especially women's) time allocation. In a general model in which both the quality and quantity of children are part of the parents' utility function, a reduction in the cost of children has an ambiguous effect on fertility (see e.g. Becker and Tomes, 1976; Cigno, 1991). Without additional restriction to the model (Cigno, 1991), we need to resort to empirical analysis in order to assess the capability of child-care services to affect fertility.

In this paper we offer new empirical evidence on this by studying the effect on fertility of the large and unexpected increase in the presence of immigrants, many of them specializing in the provision of domestic services, that occurred in Italy in 2007. To complement the findings on fertility, we also present some exploratory results on the possible impact on the "quality" of children, an area that has not been explored yet in the literature. In fact, substituting or complementing parental (mainly maternal) time with marketable services might also affect the accumulation of children's human capital: a measure of children quality.

In the literature, particular attention has been paid to the availability of, public or private, child-care services.[1] The role of public provision of child-care services has been widely discussed and recently Bauernschuster et al. (2015) have shown that in Germany the increase in the availability of publicly provided child-care services did have a sizeable effect on fertility. Similarly, another strand of the literature has focused on the so-called *marketization* of domestic services and on its effect on household behaviours – especially fertility and female labour supply. In particular, Bar et al. (2018) review in detail the marketization hypothesis and also analyse how the increased availability of child-care services bought in the market has positively affected fertility in the US. d'Albis et al. (2017), with reference to European countries, show how better access to child care – both private and public – increases the probability to have a second child, contributing to explain the differences in the fertility rates across Europe.

The effects of an inflow of migrants specializing in the provision of household services have been analysed mainly with reference to the female labour supply. Most papers[2] found a positive effect of an increase in the number of immigrants specialized in household services on women labour supply, especially for the high skilled or the highly educated ones in Hong Kong, Italy and the US.

Furtado and Hock (2010) and Furtado (2016) look at the (negative) correlation between labour supply and fertility. They find that the presence of low-skilled immigrants tends to reduce such a correlation, therefore making it more likely for women to both work and raise children.

To our knowledge, only two papers look directly at the effects on fertility. Romiti (2018) with reference to the UK finds that immigration did not affect fertility, but increased labour supply of women, especially high skilled. It also increases the probability of working for women with children. Seah (2018), on the other hand, finds a short-run negative impact of immigration on the fertility of native women right after the Miami boatlift, mainly driven by the increase in housing prices and rents. These results seem to indicate that the domestic services provided by immigrants mainly affect the probability that (highly educated) women work, rather than their fertility, contradicting the results previously mentioned relative to the effects of the availability of child-care services.

We want to re-examine this issue exploiting the natural experiment generated by the opening of the Italian borders to the "new" EU countries in 2007. In so doing, our paper aims to contribute both to literature on the impact of child-care availability and on immigrants specializing in household

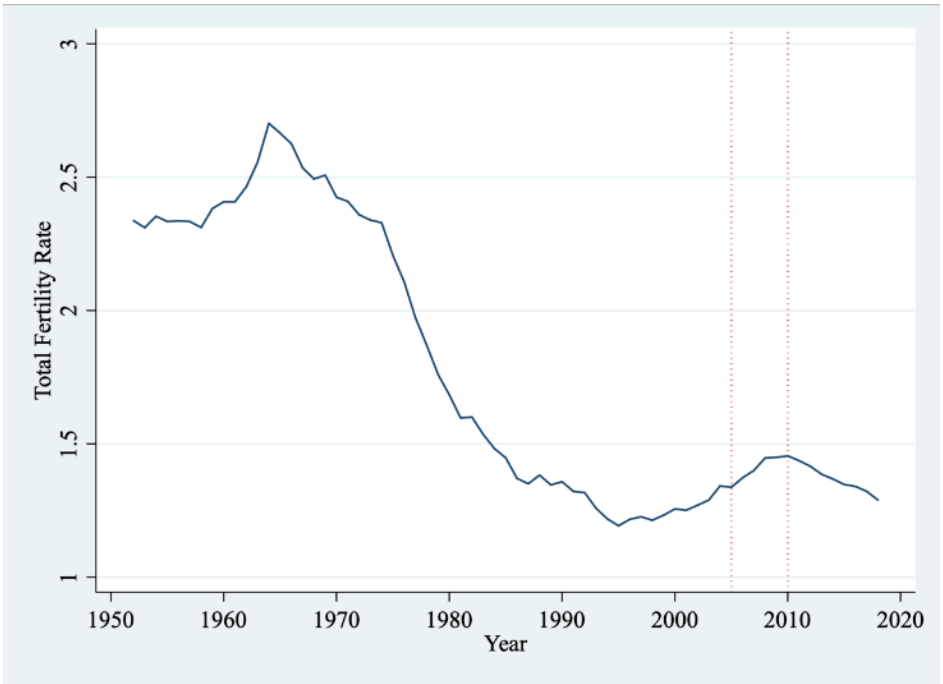
[1] For recent surveys the reader can refer to Baret al. (2018) and Bauernschuster et al. (2015).

[2] Barone and Mocetti (2001), Cortes and Pan (2013), Cortes and Tessada (2011) and Forlani et al. (2015)

services by providing novel evidence to an area of particular policy relevance where evidence is, as we have seen, scarce and, to a certain extent, contradictory.

Fertility in Italy declined substantially from the 70's to the 90's falling well beyond replacement rate, where it has remained with some oscillations in the 2000's (see Figure 1). The low fertility rate has been at centre of policy discussion for several years now. According to the latest annual report by the Italian Statistical Institute (Istat, 2020) the number of desired children exceeds the actual number, indicating that there is room for policy intervention aimed at bringing desired and actual offspring in line. Better access to domestic services provided by the market could, therefore, support such a convergence.

Figure 1: Fertility Rate in Italy (1952-2018)

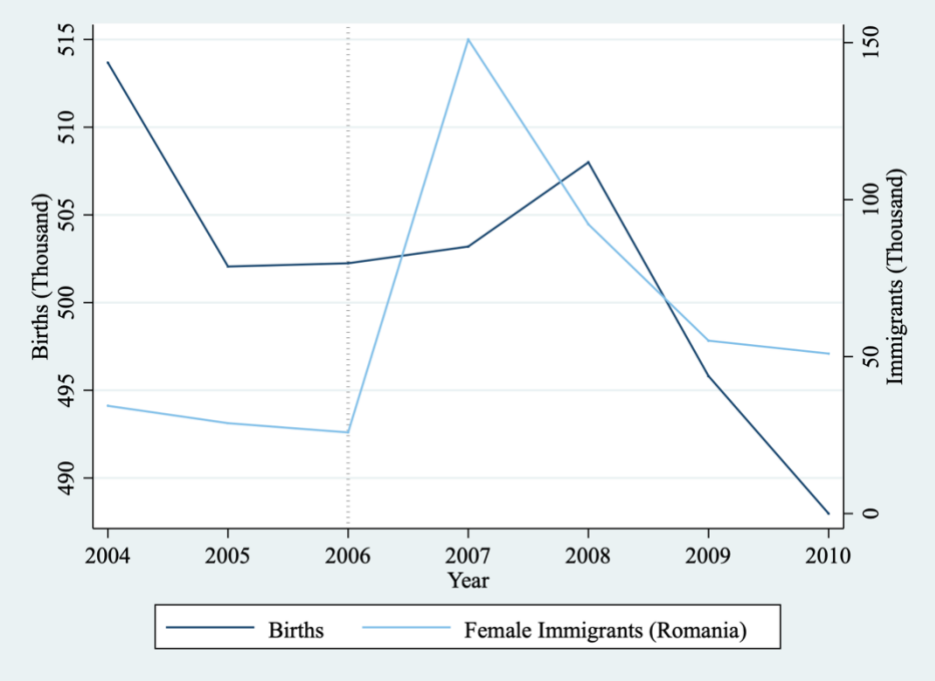


Notes: authors' elaboration on Istat data. Fertility rate is computed as the number of total children per woman at the end of her reproductive life. For women born on 1985 onward we do not observe the entire reproductive life and for them we use the imputed fertility rate. The dashed red lines represent the beginning and the end of the period of analysis.

In 2007 following the EU enlargement to the East-European countries, there was a sudden very large inflow of migrants from Romania and to a more limited extent from Bulgaria. A large part of immigrants from Romania, especially women, specialized in household services. While the possibility of large immigration flows from the new EU-member countries was widely discussed and expected, the exact timing of the actual extension of the right of free movement was unknown to the general public.

The extension of the right of free movement (with the limits that will be detailed below) to Romanians represents, therefore, a sort of natural experiment allowing us to assess the impact of a sudden and relatively large increase in the supply of domestic services on fertility in Italy (see Figure 2). In particular, we make use of administrative data at municipality level aggregated at the level of Local Market Areas (LMA) as defined by Istat[3] that contains information on births, the number of native women and the number of immigrants by country of origin. We use a double difference approach comparing LMAs where the presence of Romanian immigrant women increased substantially with those that did not experience such an increase. We estimate the impact using both a discrete and a continuous treatment. In the latter case, that is our preferred specification, we use different sets of instruments to address the possible bias due to demand pull factors.

Figure 2: Immigration and Births in Italy (2004-2010)



Notes: authors' elaboration on Istat data. Births are measured on the left-vertical scale, immigrant flows from Romania on the right-vertical scale.

[3] Labour Market Areas (LMAs, "*Sistemi Locali del Lavoro*" – "SLL" in Italy) are sub-regional geographical areas where the bulk of the labour force lives and works, and where establishments can find the largest amount of the labour force necessary to occupy the offered jobs. They respond to the need for meaningfully comparable sub-regional labour market areas for the reporting and analysis of statistics. LMAs are defined on a functional basis, the key criterion being the proportion of commuters who cross the LMA boundary on their way to work

To assess the potential effect of immigration on children's human capital, instead, we use data on standardized tests relative to the cohorts born from 2008 onwards collected by the National Institute for the Evaluation of the Education and Training System (INVALSI) and available at the Province level (NUTS-3). The empirical strategy for this part relies on the same difference-in-differences approach implemented for the analysis on fertility.

Our results show that the inflow of Romanian women specializing on the provision of domestic services had a sizeable impact on fertility, generating an increase of about 2-4 per cent in the number of births. The impact was mainly concentrated in the Centre and in the North-West of the country and was mainly due to the first large waves of immigrants. These results are robust with respect to a variety of specifications and instruments used in the estimates.

The rest of the paper is organized as follows. Next section discusses the consequences of EU enlargement for immigration flows to Italy. We than present the data and our estimation strategy in Section 3, followed by the section detailing the results. Section 5 presents some robustness tests and in Section 6 we analyse some heterogeneity profiles. Section 7 presents the exploratory analysis on learning achievements and Section 8 concludes.

2. The arrival of immigrants from "new" EU countries in 2007

In 2007 Bulgaria and Romania entered the European Union and the Schengen Area of free movement of people. Starting from 1st January 2007, Bulgarians and Romanians became EU citizens and were allowed to travel and live in all EU-member States without any restriction.[4]

The agreement was reached in 2004 and therefore the enlargement was well anticipated. Nonetheless, the EU-25 members could restrict access to workers coming from Bulgaria and Romania for a maximum of 7 years following the enlargement. Italy was among the countries that choose a transitory period with the purpose of protecting native workers from the competition of new immigrants.[5]

The free access of Bulgarians and Romanians to the Italian labour market was supposed to start on 1st January 2012. On 28th December 2006, however, the new Italian government decided to grant access to workers in agriculture, hotels and restaurants, constructions, manufacture of basic metals

[4] Already before 2007 Romanians and Bulgarians did not need a travel visa to move within the European Union. Nevertheless, they were allowed to stay in a single member country for a maximum of 90 days. After that period, they had to move to another country. In any case they were not allowed to work without a permit (Council Regulation N. 539/2001)

[5] Thanks to the *Transitional Arrangements* – set out in the Accession Treaty – Italy decided to prevent Bulgarians and Romanians to work in its labour market until 1th January 2012, when the Transitional Arrangements was suspended

and fabricated metal products, and personal service activities[6] from the very beginning of the enlargement – i.e. 1st January 2007, 3 days after the decision was made.[7]

The result was of an unprecedented increase of immigrant workers from Bulgaria and Romania employed in the authorized sectors during 2007. Figure 3 shows the ratio of immigrant to native workers in the sectors where immigrants were relatively more present.[8] As it is easy to see, the largest increase is observed in the personal service activities (NACE code 96 "Personal and household goods and a variety of personal service activities not elsewhere classified"), making the episode particularly suitable for our study.

The large increase in the employment of immigrants in personal service activities observed in 2007 – with the share of immigrant workers increasing from 0.19 in 2006 to 0.55 in 2009 – was associated to a redoubling of the share of Romanians employed in the sector – increasing from about 0.12 to 0.25 – while the share of Bulgarians in the sector remained fairly constant around the low level of 2006 (see Figure 4).

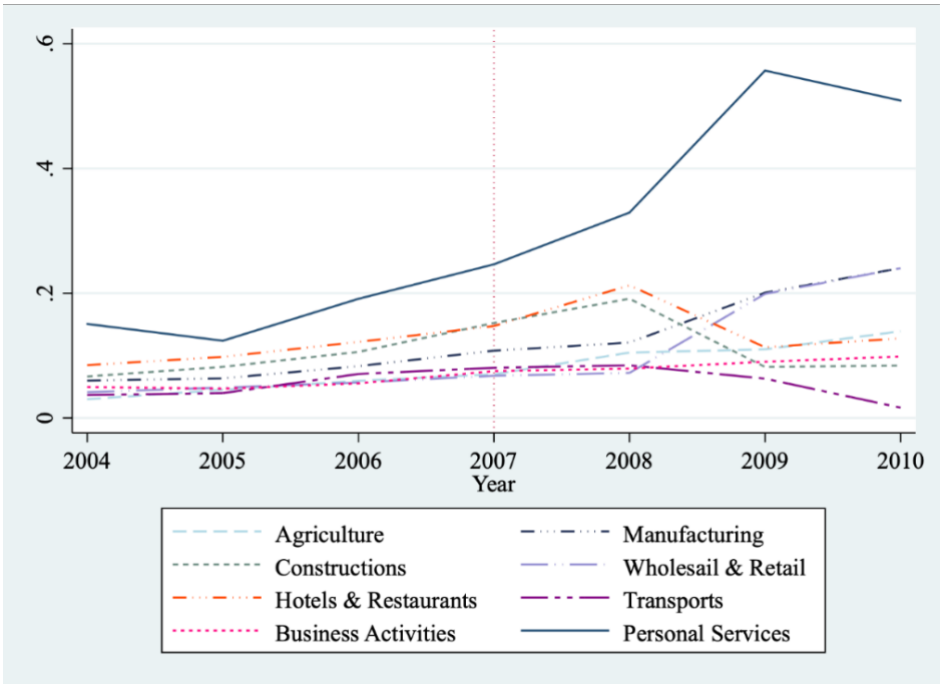
Therefore, it appears that the supply shock in the personal service activities was mainly due to the arrival of workers from Romania. In fact, in the period considered, there was an overall increase in the employment in the personal service activities of about 20 per cent coupled with an increase of 200 per cent in the number of immigrants and of 400 per cent of Romanians, associated to a reduction of about 20 per cent of native employment. Moreover, women represented by far the majority (more than 80 per cent in 2006, see Table A 1 in Annex A for details) of Romanian workers employed in personal service activities. For all these reasons, in the analysis that follows, we will concentrate on the impact of the sudden increase of Romanian female workers in the personal service sector on the native household fertility choices.

[6] According to NACE rev.2 (or equivalently ISIC rev.4) those sectors are classified as: 01/03 (Agriculture), 24/25 (Manufacture of basic metals), 41/43 (Construction), 55/56 (Accommodation and food service activities), and 96 (Personal and household goods and a variety of personal service activities not elsewhere classified)

[7] Other papers have used the same natural experiment, namely Mastrobuoni and Pinotti (2015) and Adamopoulou and Kaya (2019)

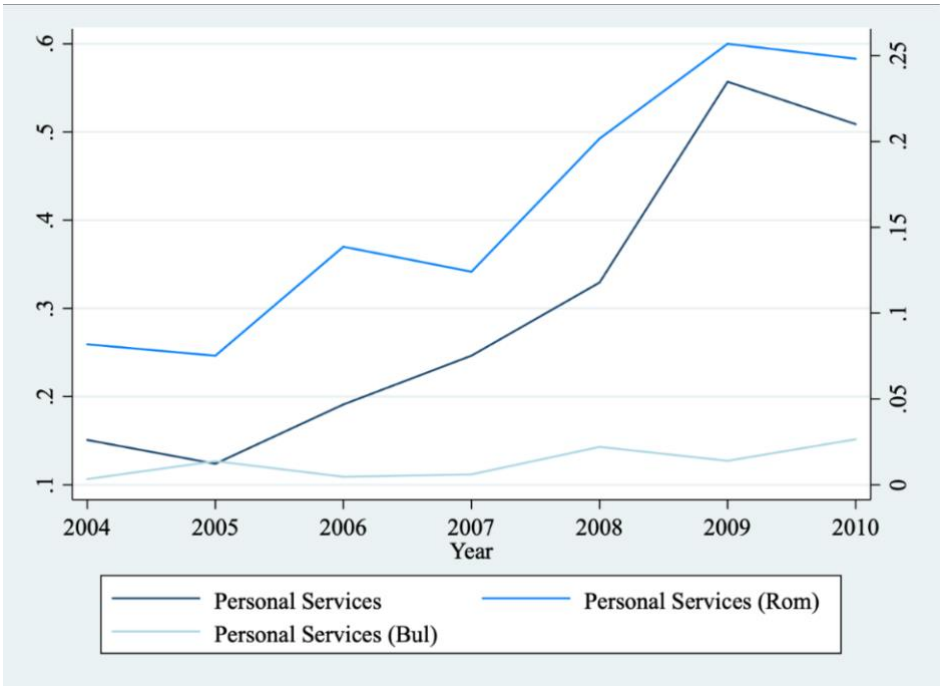
[8] We show the data for sectors where the ratio of immigrants exceeded the national average in 2006

Figure 3: Immigrants Workers by Sector



Notes: authors' elaboration on LFS data. Sectors above the average immigration rate in Italy are plotted. On the vertical axis is measured the immigrant rate with respect to native workers.

Figure 4: Shares of Immigrant Workers in Personal Service Activities

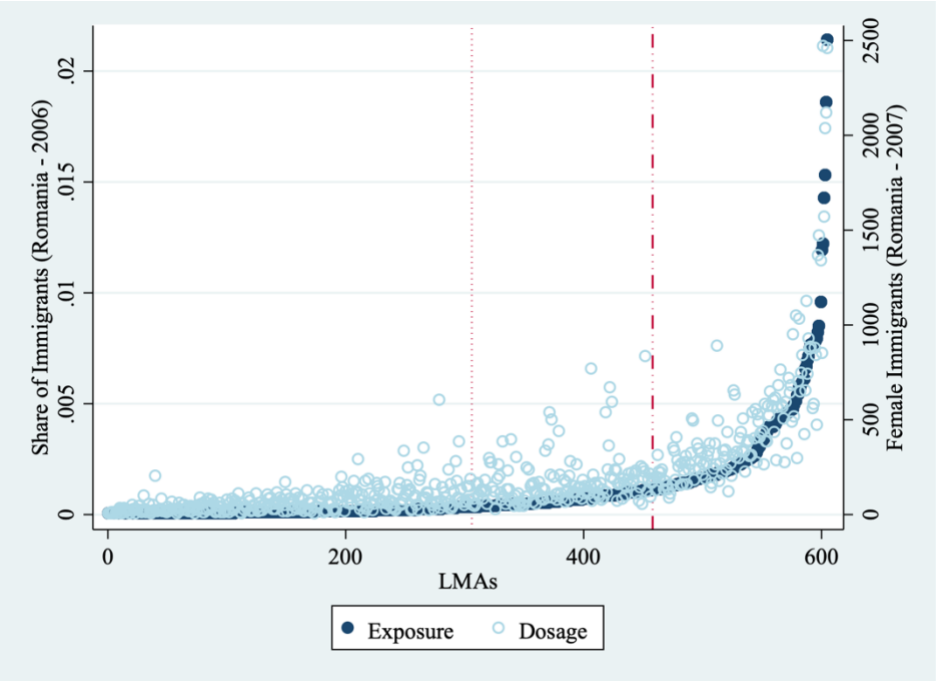


Notes: authors' elaboration on LFS data. On the left-hand-side vertical axis is measured the ratio of immigrant over native workers in the sector of personal service activities. On the right-hand-side vertical axis is measured the share of immigrant workers from Romania and Bulgaria employed in the same sector.

3. The Empirical Strategy

To estimate the effect of immigration on native fertility we exploit the fact that the distribution of new arrivals across the country is influenced, especially for low-skilled workers, by the existing networks of immigrants of the same origin.[9] Therefore, the share of immigrants from a specific country living in an area is a very good predictor of the likelihood of the area to receive additional immigrants from the same country. As shown in Figure 5, the areas where the share of immigrants from Romania was relatively high in 2006 – the year before the enlargement – are also the areas that experienced a relatively larger flows in 2007.

Figure 5: Exposure to Treatment and Dosage



Notes: authors' elaboration on Istat data. LMAs are ordered on the basis of the 2006 share of immigrants from Romania. The exposure to the treatment is the share of immigrants from Romania in 2006 and it is measured on the left-hand vertical axis. The dosage of the treatment is the flow of female immigrants from Romania in 2007 and it is measured on the right-hand vertical axis. The five most exposed LMAs are excluded from the graph.

[9] For a detailed analysis of immigrant location choice see Bartel (1989). For a description of the geographical distribution of immigrants in Italy see Mariani et al. (2020)

On this basis, we use a Difference-in-Differences (DiD) approach to estimate the impact of immigration of native fertility. In particular, we use both a discrete and a continuous treatment. For the discrete case we consider as treated the LMAs above the median or above the 75th percentile of the distribution of the share of Romanian immigrants in 2006. The dotted red line of Figure 5 depicts the median LMA according to the distribution of the Romanian-immigrant network in 2006 and the dashed red line is the 75th percentile.

As the selection of a threshold to separate treated and untreated LMAs remains somehow arbitrary, we also estimate a DiD with a continuous treatment – our preferred approach – where the dosage is given by the number of immigrant women from Romania living in the same area.

In particular, in the discrete case we estimate the following model:

$$(1) \qquad Y_{i,t} = \beta_0 + \beta_1 Post_t * Treat_{i,2006} + \beta_2 \boldsymbol{W}_{i,t-1} + \beta_3 \boldsymbol{X}_{i,2006} + \lambda_i + \tau_t + \varepsilon_{i,t}$$

where $Y_{i,t}$ is the number of births to Italian women aged 15- 49 in LMA i at year t. $Post_t$ is a dummy variable equal to 1 for the years after 2007 and $Treat_{i,2006}$ is a dummy equal to 1 for LMAs with a share of immigrants from Romania in 2006 higher than the 50th or the 75th percentile, according to the model specification. $\boldsymbol{W}_{i,t-1}$ is a vector containing the number of Italian women aged 15-49 and the age composition of the female population at year $t-1$.[10] $\boldsymbol{X}_{i,2006}$ is a vector of pre-treatment controls, λ_i and τ_t are LMA and year fixed effects, and $\varepsilon_{i,t}$ is the idiosyncratic error term.

As mentioned, in our preferred specification, we use a continuous treatment – lagging immigration by one year and estimating the following equation:[11]

$$(2) \qquad Y_{i,t} = \beta_0 + \beta_1 Post_t * Imm_{i,t-1} + \beta_2 \boldsymbol{W}_{i,t-1} + \beta_3 \boldsymbol{X}_{i,2006} + \lambda_i + \tau_t + \varepsilon_{i,t}$$

where the variables maintain the same meaning and $Imm_{i,t-1}$ is the number of immigrant women from Romania in LMA i at year $t-1$. The estimates are carried out for the period 2005 – 2010.

[10] Given the duration of gestation, it is reasonable to suppose that most of the births observed in year t are from women observed in year $t-1$. We will test the robustness of our estimate to this assumption.

[11] See e.g. Abramitzky et al. (2019), Clements et al. (2018) and Theoharides (2020) for a similar empirical strategy applied to the analysis of the impact of migration. See Bauernschuster et al. (2015) for an application of the same strategy to a fertility policy evaluation

Time and space fixed effects are added to all the estimates to control for time invariant location characteristics and common time trends.

We employ a formulation in levels rather than in rates to avoid the well-known issue of spurious correlation due to the presence of the same variable in the denominator of both left- and right-hand-side variables. This is a well-known problem probably discussed for the first time in Pearson (1896). For a more recent discussion (also with reference to fertility) see Kronmal (1993) and with reference to the labour-market effects of immigration see Clemens and Hunt (2019).[12]

As we use data at the municipality level (subsequently aggregated at the LMA level) we can rely on a limited number of controls. We have, however, information on the employment rate, the per capita income and the per capita expenditure on public services to childhood (mainly kindergarten) that proxy for some income and cost elements possibly affecting fertility choices. We also control for potential biases due to different compositions of the LMA native female population including age-specific population shares.

3.1. Identification

Estimation of equations (1) and (2) with OLS results in unbiased estimates if the number of immigrants in the LMAs are exogenous to the fertility rate. This hypothesis is violated in the case of omitted variables (observable and unobservable) that are correlated both with the likelihood of attracting new immigrants and the fertility decision of native women.

While non time-varying effects and common trends are absorbed by the fixed effects in the estimates, the problem of bias due to omitted variables that change in the post-treatment period cannot be dismissed. Additionally, we could have a positive bias if immigrants decide to locate where the demand for personal service is growing due to higher (actual or planned) fertility. In both cases – unobservable factors and reverse causality – bias from self-selection into treatment might arise and to obtain an unbiased estimation of the treatment effect we use an instrumental variable approach.

We use three different sets of instruments to estimate equation (2): all estimates produce very similar results supporting the validity of the inference. In particular, we use a shift-share instrument based

[12] One possible problem with a formulation in levels is that the estimation is susceptible to outliers. As suggested by Kronmal (1993), we use a Weighted Least Square regression to deal with this problem. We also trim the data for the upper and lower 1 per cent tail. Both approaches – the WLS estimation and the trimming procedure – produce results that are very similar to those presented here.

on the shares of immigrants from Romania in the pre-treatment period. Because data availability at the LMA level does not allow us to use shares far in the past, raising doubts about the validity of the instrument, we also use the distance from the gateway of entry as an instrument to control for the allocation of immigrants across LMAs. Finally, we aggregate municipal data at provincial level (NUTS 3) and re-estimate our model using the shift-share instrument with the shares of immigrants by Province observed in 1991.[13]

As mentioned, for the first IV approach we exploit the well-known fact that immigrants of the same origin tend to cluster and that ethnic networks are likely to attract newcomers, so we use a slightly different version of the instrument à la Card (2001). The instrument we use closely mimics a shift-share instrument, as it weights the current flows of female immigrants from Romania with the share of Romanians of both genders in each LMA in the year prior the treatment:

$$Z_{i,t} = \vartheta_{i,2006} * \Delta Imm_{Ita,t} \quad (3)$$

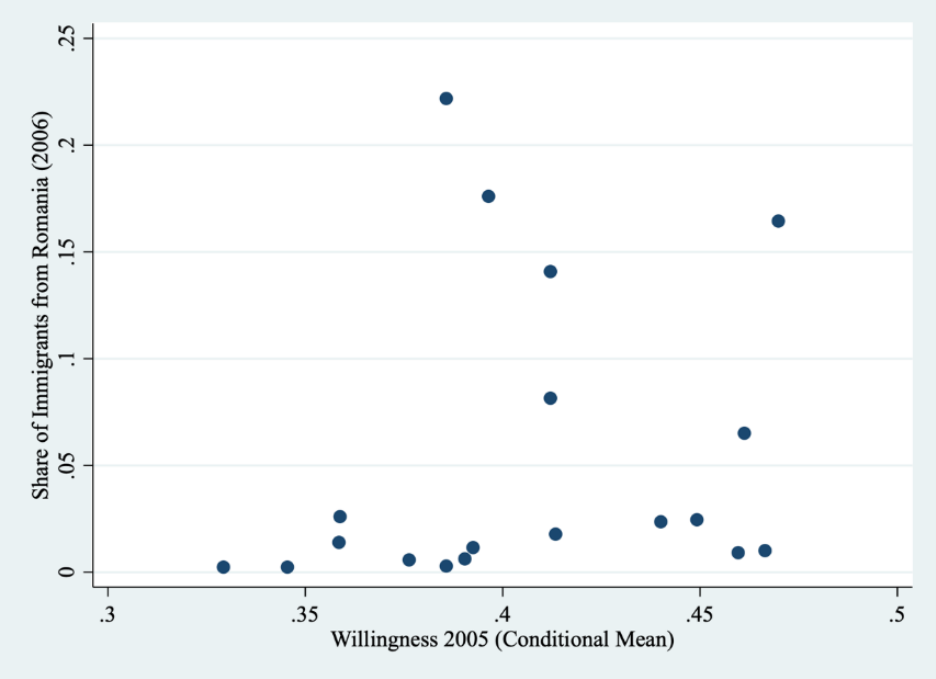
$\vartheta_{i,2006}$ is the share of Romanians – men and women – living in LMA i in 2006 and $\Delta Imm_{Ita,t}$ is the flow of Romanian women in Italy at time t. Therefore, we allocate women from Romania arrived from 2007 on the basis of the distribution of their countrymen in the pre-treatment period.

As it is well known, the shift-share instrument is valid if the shares employed can be considered exogenous to the outcome of interest. Data limitations do not allow us to use shares earlier than 2006 and this might limit the validity of the instrument. We have some elements, however, that help us to reduce these concerns. The distribution of the shares of immigrants from Romania shows a change from 2007 onwards, indicating that shares observed before 2007 are not linked to pull factors observed after that year as confirmed by the Epps-Singleton test (see Table B 2 in Appendix B). Moreover, we employ the shares relative to Romanian immigrants of both genders and not only of women, as it appears reasonable that the network effect is not linked only to women. This should reduce the impact of the presence of any demand-pull factor, as the majority of Romanian immigrants, especially males, works in different sectors (in 2007 only about 17 per cent of the Romanian immigrant men worked in the personals service sector).[14]

[13] Data by the 1991 census are available only at the province level

[14] See CNEL (2008), p. 27. This figure is in line with the share reported in Table A 2

Figure 6: Correlation between the Share of Romanians and the Intention to Have Additional Children



Notes: authors' elaboration on Istat data. On the horizontal axis we plot the regional shares of native women that intend to have additional children, controlling for the number of children, the level of education and the age. On the vertical axis we plot the regional shares of immigrants from Romania.

We also look directly at the possible correlation between the immigrant shares and the outcome of interest: the number of births. Using a survey conducted by Istat in 2005 on births and mothers,[15] we look at the correlation between the Italian women's desire of having additional children in 2005 and the allocation of immigrants from Romania in 2006, which we use to compute our instrumental variable. In Figure 6 we plot the shares of Romanians and the percentage of women desiring additional children by Region, controlling for age, education and the number of cohabiting children of native women. It does not appear that the regional allocation of Romanian was in any way correlated with the demand for children, thus offering additional support to the hypothesis that the distribution of Romanians in Italy was not affected by demand-pull factors linked to (desired) fertility. As discussed, we also use as an alternative instrument: the distance to immigrants' entry gateways in Italy. The distance from gateways of entry or from country of origin has been employed as an

[15] The "Indagine campionaria sulle nascite e le madri" (https://www.istat.it/it/archivio/6485) is a survey carried out by Istat in 2002, 2005 and 2012 in order to collect information about mothers' health and their reintegration in the labour market after the child birth

instrument in several studies, relative to Italy as well as to other countries.[16] In particular, we use as an instrument the distance between each LMA and the closest gateway multiplied by the flow of women from Romania, in order to generate a time-varying instrument. As gateways of entry have not been changing over time, the instrument can be considered as exogenous.
In particular, the instrument we use is given by:

$$Z'_{i,t} = dist_{i,clostest\ gateway} * \Delta Imm_{Ita,t} \quad (4)$$

$dist_{i,clostest\ gateway}$ is the distance between LMA i and the closest gateway of entry and $\Delta Imm_{Ita,t}$ is the flow of women from Romania to Italy at time t.
According to the data by the Italian Ministry of Interior, most immigrants from Romania entered Italy from the two main airports (Milano Malpensa and Rome Fiumicino) and from the land route of Slovenia (Valico di San Bartolomeo). For each LMA we compute the distance to these gateways, and then we consider only the minimum value of the three. Therefore, for LMA i the probability to receive new immigrants at time t is inversely related to the distance to the gateway and proportional to the aggregate flow to Italy.
Finally, we also estimated equation (2) using a more standard shift-share instrument based on the shares of immigrants in 1991.[17] Because of data limitations, for this exercise we had to carry out the analysis at the province level (NUTS3) rather than at the LMA level, substantially reducing the spatial variation. In fact, the data from the 1991 census do not provide information on nationality at the municipal level, but only at the provincial level. Moreover, the information about the immigrants' nationality is limited to the macro areas of origin[18] and, therefore, we consider all immigrants rather than Romanian women only. In formula, the third instrument is:

[16] See, among others, Mocetti and Porello (2010), Peri (2012), Smith (2012), Ortega and Peri (2014), and Llull (2018)
[17] During the 80's immigration in Italy was negligible, therefore we decided not to use the data from the previous (1981) census. More precisely, Italy registered for the first time a positive net migration at the end of the '70s and experienced the first wave of mass immigration after the collapse of the Eastern Bloc, at the beginning of the '90s.
[18] The macro areas of origin in the 1991 census are: North Africa, Other Africa, Centre-South America, North America, Asia, Oceania, Eu-12, Europe Efta and Centre-East Europe

(5) $\quad Z''_{i,t} = \sum_{m=1}^{M} \vartheta_{i,1991}^{m} * \Delta Imm_{ita,t}^{m}$

$\vartheta_{i,m}^{1991}$ is the share of immigrants from macro area m living in province i in 1991 and $\Delta Imm_{ita,t}^{m}$ is the flow of immigrants from macro area m to Italy at time t.

3.2. Data and Balance

The data used in the analysis are mainly drawn from the administrative records collected by the Italian national statistical institute (Istat). In particular, the number of births and of native women by age group is registered at the municipality level and refers to the inter-census years, i.e. from 2001 to 2010.[19] Data on immigrants by citizenship are collected at the municipality level from 2003, therefore data on flows are available from 2004. We then aggregate the data at the LMAs using the 2011 Istat classification.[20]

The employment rate is obtained from the Italian Labour Force Survey (LFS), personal income data are from the tax records of the Italian Ministry of Finance, and the share of public expenditure in child-care services – *servizi all'infanzia* – is from Istat register data. They are collected at the municipality level and aggregated at LMA level. Data on employment rate and child-care municipal expenditure are available from 2006 to the end of the period. Given that we need data at municipality level (subsequently aggregated at the LMA level) the number of possible covariates on which information is available is limited to the aforementioned ones.

In Table 1 we present the results of the balance test for the outcome variable and the controls just described. Obviously balance tests can only be carried out for the discrete treatment case, but they serve also as an indication for the balance of basic characteristics of the LMAs in the continuous treatment case. The last column of the same table presents the normalized difference – computed following Imbens and Rubin (2015) – that provides a scale-invariant measure of the size of the difference. Imbens and Rubin (2015) argue that a normalized difference higher than 1 might be a cause of concern, while below a value of 0.25 seems to indicate a good balance. In our case, while the outcome variable appears to be well balanced by all criteria, the standard t-test indicate imbalances in some other variables and most of the normalized differences are above 0.25, but below one.

[19] Data on native women by age and municipality are available from 2001, data on births are available from 2002

[20] For details see https://www.istat.it/en/labour-market-areas

Table 1: Balance Test (Baseline - 2006)

	Treated		Control		Difference		Normalized
Panel A: Median							
Fertility Rate	0.04	[0.00]	0.04	[0.01]	0.00	(0.00)	0.02
Per Capita Child-Care Services	219.56	[142.48]	106.30	[90.85]	113.26***	(9.68)	0.67‡
Per Capita Income	10 813	[2248.95]	7 089	[2735.71]	3 724***	(202.92)	1.05‡
Employment Rate	47.94	[5.83]	39.04	[7.21]	8.90***	(0.53)	0.96‡
Internal Flows	67.34	[624.07]	-37.77	[102.50]	105.11**	(36.27)	0.17
Share of Women 15-24	0.21	[0.02]	0.24	[0.03]	-0.04***	(0.00)	-1.05‡
Share of Women 25-34	0.29	[0.01]	0.29	[0.01]	-0.00	(0.00)	-0.02
Share of Women 35-44	0.35	[0.02]	0.32	[0.02]	0.03***	(0.00)	0.96‡
Share of Women 44-49	0.16	[0.01]	0.15	[0.01]	0.01***	(0.00)	0.68‡
Panel B: 75th percentile							
Fertility Rate	0.04	[0.00]	0.04	[0.01]	0.00*	(0.00)	0.15
Per Capita Child-Care Services	260.75	[155.02]	130.46	[105.34]	130.28***	(11.20)	0.70‡
Per Capita Income	11 832	[1761.85]	7 997	[2875.33]	3 835***	(247.43)	1.14‡
Employment Rate	50.21	[4.40]	41.26	[7.57]	8.96***	(0.65)	1.02‡
Internal Flows	120.41	[861.71]	-20.23	[139.57]	140.65***	(41.81)	0.16
Share of Women 15-24	0.20	[0.02]	0.23	[0.03]	-0.04***	(0.00)	-0.98‡
Share of Women 25-34	0.29	[0.01]	0.29	[0.01]	0.00	(0.00)	0.08
Share of Women 35-44	0.36	[0.01]	0.33	[0.02]	0.03***	(0.00)	0.91‡
Share of Women 44-49	0.16	[0.01]	0.15	[0.01]	0.01***	(0.00)	0.56‡
Observations	152		458		610		610

Notes: authors' elaborations. * p<0.10, ** p<0.05, *** p<0.01. ‡ >0.25 (Imbens and Rubin, 2015).

For these reasons, we include the covariates at the pre-treatment date of 2006 in all our regressions to control for possible imbalances by stratification. However, this approach has been criticized in the context of randomized experiments (e.g. Bruhn and McKenzie, 2009). Therefore, we also have run all our regressions without controls and the results (not presented here, but available on request) do not differ in any substantial way from those presented here.

Table 2 presents the summary statistics on the variables used in the estimates.

Table 2: Summary Statistics (2005 – 2010)

	Mean	St. Dev.	Min	Max
New-Born Babies	819	2 318	13	32 532
Native Women (15-49)	20 818	55 285	583	760 782
Fertility Rate	0.038	0.005	0.020	0.068
Share of Immigrants from Romania (2006)	0.002	0.008	0	0.159
Female Immigrants from Romania (Stock 2004-2006)	126	895	0	27,168
Female Immigrants from Romania (Stock 2007-2009)	386	2086	0	62,284
Female Immigrants from Romania (Flow 2004-2006)	24	176	-9	6 320
Female Immigrants from Romania (Flow 2007-2010)	82	457	-161	13 557
Per Capita Child-Care Services (2006)	162.93	132.07	0	959.64
Per Capita Income (2006)	8 954	3 117	3 122	27 136
Employment Rate (2006)	43.49	7.92	23.1	63.7
Share of Native Women 15-24	0.224	0.032	0.154	0.340
Share of Native Women 25-34	0.277	0.017	0.206	0.353
Share of Native Women 35-44	0.339	0.027	0.264	0.423
Share of Native Women 44-49	0.160	0.0162	0.109	0.231
Observations	3660			

Notes: authors' elaboration on Istat data. Yearly public expenditure in child-care services and per capita income are measured in Euros.

4. Results

The estimates of the difference-in-differences model presented in Section 3 (equation 1) are reported in Table 3. The first column of the table shows that on average after 2007 the LMAs more exposed to the treatment – i.e. the LMAs hosting a share of immigrants from Romania that was above the median in 2006 – have experienced an increase in the fertility by 18 additional births. This increase grows to 28 if we consider LMAs above the 75th percentile (column 2 of Table 3). In relative terms, the increase is 2.1 and 3.4 per cent respectively of the sample mean at baseline (see last row of Table 3).

As mentioned, the choice of the threshold for a binary treatment is somehow arbitrary. For this reason, we estimate the DiD model with a continuous treatment. Column 1 of Table 4 shows the result for this model (equation 2 of Section 4). Immigrant women from Romania continues to have a positive effect on the number of births – for every 40 additional immigrants we observe an additional birth

after 2007. In percentage terms, immigration from Romania appears to have increased the number of births by about 2 per cent.[21]

Table 3: Effect of Immigration on Native Births (Binary Treatment)

	(1) Births	(2) Births
50-Perc. * Post	17.73*** (5.131)	
75-Perc. * Post		27.95*** (10.36)
Native Women (15-49)	0.0246* (0.0134)	0.0251* (0.0133)
Observations	3,654	3,654
R-squared	0.999	0.999
Controls	YES	YES
Year FE	YES	YES
LMA FE	YES	YES
Avg Num. of Births (pre-treatment)	824	824

Notes: authors' elaboration on ISTAT dataset. Controls include yearly age-specific population shares, per-capita income, child-care services and the employment rate in 2006. Data on per-capita income comes from the Ministry of Finance which uses an older classification for the LMAs, so data on the per-capita income of "Corigliano-Rossano (1845)" LMA are missing. Models in column (1) and (2) refer to a DiD with a dichotomous treatment in which treated and control groups are defined according to the distribution of ethnic networks in 2006. Robust standard errors are clustered at the LMA level. * p<0.10, ** p<0.05, *** p<0.01

As discussed above, in order to deal with the possible endogeneity of immigration, we implement an IV approach using a slightly different version of the instrument à la Card. The results are presented in column 2 of Table 4. The 2SLS coefficient remains positive and significant, and of similar magnitude – confirming that immigration from Romania after 2007 have positively affected native fertility.

As mentioned in Section 3, in order to address possible identification issues related to the fact that we employ a recent share for the instrument, we have also carried out the estimates using the distance from the gateway of entry of the immigrants as an instrument. The 2SLS coefficient is presented in the last column of Table 4 and it suggests that our estimates are robust both in terms of significance and of magnitude. The first stage F-statistics drops to 16.48, but it is still above the customary level of 10.

[21] This figure is obtained by multiplying the coefficient 0.0269 by the average number of female immigrants from Romania in the post-period and dividing it by the average number of births in the pre-period (see Table A 3 in Annex A)

Table 4: Effect of Immigration on Native Births (Continuous Treatment)

	(1) Births OLS	(2) Births IV - Network	(3) Births IV - Distance
Female Immigrants (Romania) * Post	0.0269***	0.0578***	0.0560***
	(0.00924)	(0.0173)	(0.0142)
Native Women (15-49)	0.0507***	0.0814***	0.0796***
	(0.0182)	(0.0281)	(0.0226)
Observations	3,654	3,654	3,654
R-squared	0.222	0.061	0.080
Controls	YES	YES	YES
Year FE	YES	YES	YES
LMA FE	YES	YES	YES
F Stat		129.165	16.476

Notes: authors' elaboration on ISTAT dataset. Controls include yearly age-specific population shares, per-capita income, child-care services and the employment rate in 2006. Data on per-capita income comes from the Ministry of Finance which uses an older classification for the LMAs, so data on the per-capita income of "Corigliano-Rossano" (1845) LMA are missing. Model in column (1) refers to a DiD with a continuous treatment estimated with an OLS method. Models in column (2) and (3) refer to a DiD with a continuous treatment estimated with a 2SLS method. In column (2) the instrumental variable is the shift-share instrument explained in equation (3). In column (3) the instrumental variable is based on the distance to gateways of entry as explained in equation (4). The reported F Statistics is the Kleinbergen-Paap rk Wald F Statistics. Table D 1 in Annex D shows the first-stage regression coefficients. Robust standard errors are clustered at the LMA level. * p<0.10, ** p<0.05, *** p<0.01

Moreover, some authors (Jaeger et al., 2018; Goldsmith-Pinkham et al., 2020) indicate that the shares of migrants used in the instrument might be spuriously correlated with the outcome of interest if the latter is serially correlated. In case of a DiD analysis, what is essential for the identification is that the first differences of the outcome are not serially correlated. The Dickey-Fuller test for autocorrelation reported in Annex B shows that fertility is indeed stationary in the first differences. Bertrand et al. (2004) argues that the estimates of the standard errors, obtained through OLS or 2SLS, of a DiD model whose outcome is serially correlated in the levels are inconsistent. To overcome this problem is possible either to compute standard errors clustered at the level of the unit of analysis or to bootstrap the standard errors.[22] The former is already implemented in our analysis, the results of the latter are presented in the following table. The standard errors computed with the two methods are rather similar and do not change the confidence interval of the estimated coefficients. Furthermore, with the use of a bootstrap procedure to compute the standard errors, we avoid making any assumption on the variance-covariance matrix of the residuals. So, our inference method is

[22] The suggested number of replications is 50 minimum (see Green, 2012 and Bertrand et al., 2004). We compute the bootstrapped standard errors with 200 replications

consistent also in case of other possible dependence patterns in the error component (Adao et al., 2020).

Table 5: Effect of Immigration on Native Births (Bootstrapped Standard Errors)

	(1) Births OLS	(2) Births IV - Network	(3) Births IV - Distance
Female Immigrants (Romania) * Post	0.0269**	0.0578***	0.0560***
	(0.0106)	(0.0201)	(0.0144)
Native Women (15-49)	0.0507**	0.0814**	0.0796***
	(0.0201)	(0.0343)	(0.0235)
Observations	3,654	3,654	3,654
Number of LMAs	609	609	609
Controls	YES	YES	YES
Year FE	YES	YES	YES
LMA FE	YES	YES	YES

Notes: authors' elaboration on Istat data. Controls include yearly age-specific population shares, per-capita income, child-care services and the employment rate in 2006. Data on per-capita income comes from the Ministry of Finance which uses an older classification for the LMAs, so data on the per-capita income of "Corigliano-Rossano (1845)" LMA are missing. Model in column (1) refers to a DiD with a continuous treatment estimated with an OLS method. Models in column (2) and (3) refer to a DiD with a continuous treatment estimated with a 2SLS method. In column (2) the instrumental variable is the shift-share instrument explained in equation (3). In column (3) the instrumental variable is based on the distance to gateways of entry as explained in equation (4). The F statistics of the first stage is omitted by the statistical software (Stata) when standard errors are computed with a bootstrap procedure. Bootstrapped standard errors are computed with 200 replications. * p<0.10, ** p<0.05, *** p<0.01

Table 6: Effect of Immigration on Fertility – 1991 immigrant shares

	(1) Births OLS	(2) Births IV - Network (1991)
Immigrants * Post	0.00563***	0.00424**
	(0.00197)	(0.00210)
Women (15-49)	0.0756***	0.0642***
	(0.0228)	(0.0189)
Observations	570	570
R-squared	0.777	0.774
Controls	YES	YES
Province FE	YES	YES
Year FE	YES	YES
F Stat		73.478

Notes: authors' elaboration on Istat data. Controls include yearly age-specific population shares, per-capita income, child-care services and the employment rate in 2006. Models in column (1) and (2) refer to a Diff-in-Diff with a continuous treatment estimated respectively with an OLS and an IV approach. The reported F Statistics is the Kleinbergen-Paap rk Wald F Statistics. Robust standard errors are clustered at the LMA level. * p<0.10, ** p<0.05, *** p<0.01

Finally, in Table 6 we present the results estimated at provincial level using a shift-share instrument based on immigrants' shares from 1991. The coefficient relative to the flow of immigrants is positive and significant. Because of the different level of territorial aggregation, the coefficient cannot be directly compared to the estimates presented above. However, we can note that the estimates imply an increase of births to native women of about 4 per cent close to the results obtained from the other models.[23]

In conclusion, the results look very robust across different estimations using a variety of instruments, indicating that the unexpected flow of Romanian women specializing in personal services did generate a sizable increase in the fertility of native women.

5. Robustness

In a DiD framework, the parallel-trend assumption is fundamental – treated and untreated units must share a common trend in the pre-treatment period. In this section we test for this hypothesis.

Table 7: Parallel Trend and Placebo Test for the DiD Model with a Continuous Treatment

	(1) OLS Births	(2) OLS $\Delta_{(05-07)}$Births
Female Immigrants (Romania - 2006)	-0.0128	
	(0.00908)	
Native Women (15-49)	-0.00096	
	(0.0125)	
$\Delta_{(04-06)}$Female Immigrants (Romania)		0.0310
		(0.0277)
$\Delta_{(04-06)}$Native Women (15-49)		0.0174
		(0.0116)
Observations	1,830	610
R-squared	0.034	0.027
Controls	NO	NO
Year FE	YES	NO
LMA FE	YES	NO

Notes: authors' elaboration on Istat data. Columns (1) refers to a DiD model computed on the years 2005-2007 and considering 2007 as the post-treatment year. Column (2) refers to a linear regression model in which the dependent variable is differentiated over the years 2007-2005 and the covariates are differentiated over the years 2006-2004. In Columns (1) errors are clustered at the LMA level. Robust standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01

[23] This figure is obtained by multiplying the coefficient 0.00563 by the average number of immigrants at the province level after 2007 (40 069) and dividing it by the average number of births at the province level before 2007 (5261)

To this aim we carry out two tests. In the first we estimate equation (2) for the pre-treatment period only. In particular, we estimate the model for the period from 2005 to 2007, considering 2007 as the treatment year.[24] The results for the OLS are presented in columns 1 of Table 7 and show that the placebo treatment is not significantly linked to any change in the fertility observed in the pre-treatment years.

The second test consists in estimating a linear regression model in which both the dependent variable and the covariates are differentiated over the pre-treatment years. The results are shown in the second column of Table 7 and suggest that the variation in the number of births is not correlated with the variation in the female immigrant population in the pre-treatment period.

In equation (2) we have assumed a lag of one year in the impact of the treatment on the outcome variable, on the base of the obvious consideration of the duration of the pregnancy. However, as some of the effect of the inflows of Romanian women might have happened already in 2007, as a further test we estimate the DiD model with no lags on the treatment variable. The results are presented in the first two columns of Table 8.

Table 8: Estimation Results of the DiD with a Continous Treatment (No Lag)

	(1) Births	(2) Births	(3) Births	(4) Births
Female Imm. (Romania) * Post	0.0262***	0.0162***	0.0317***	0.0668***
	(0.00845)	(0.00595)	(0.0114)	(0.0170)
Native Women (15-49)	0.0520***	0.0414***	0.0571***	0.0857***
	(0.0179)	(0.0150)	(0.0196)	(0.0266)
Observations	3,654	3,654	3,654	3,654
R-squared	0.215	0.198	0.308	0.165
Controls	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
LMA FE	YES	YES	YES	YES
F Stat		189.700		75.620

Notes: authors' elaboration on Istat data. In Columns (1) and (2) the post-period is from 2007 onward. In Columns (3) and (4) the post-period is from 2008 onward and 2007 is excluded from the analysis. Controls include yearly age-specific population shares, per-capita income, child-care services and the employment rate in 2006. Data on per-capita income comes from the Ministry of Finance which uses an older classification for the LMAs, so data on the per-capita income of "Corigliano-Rossano (1845)" LMA are missing. Robust standard errors are clustered at the LMA level. * p<0.10, ** p<0.05, *** p<0.01

[24] Recall that the number of births of year t are regressed on the number of female immigrants living in Italy in year $t-1$, so for this exercise we refer to immigrants living in Italy during the period from 2004 to 2006.

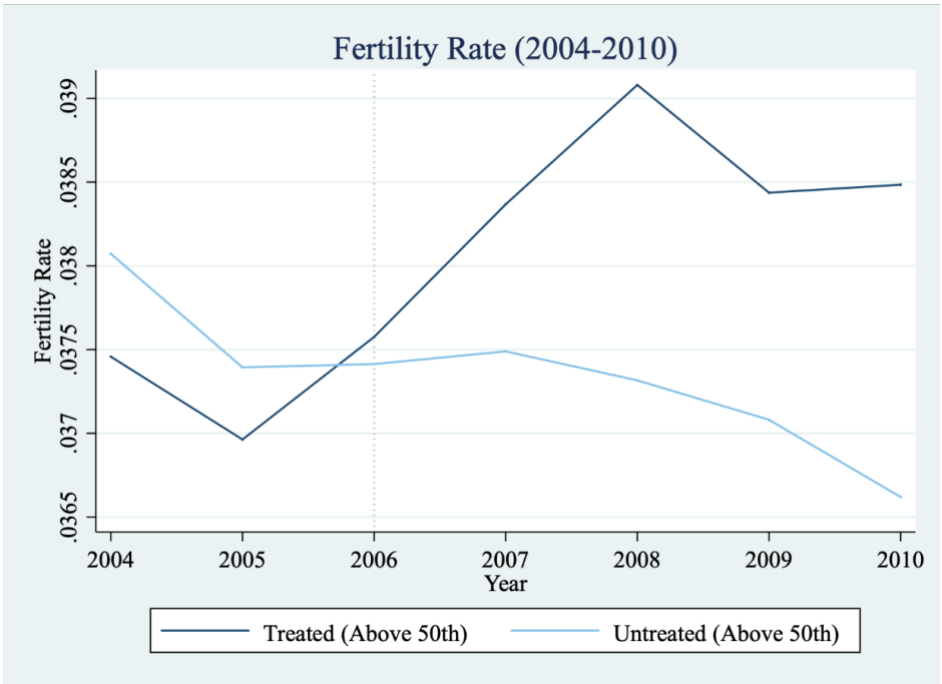
The coefficient of the treatment variable is positive and significant but of substantially smaller magnitude with respect to the estimates obtained using the lagged variable. These results indicate that while some effect of the large immigration flows of Romanian women might have affected the number of births in the same year of their arrival, the largest part of the impact appears to have happened with a lag, as it is reasonable. Therefore, our preferred estimates remain those obtained lagging the immigrant flows by one year.

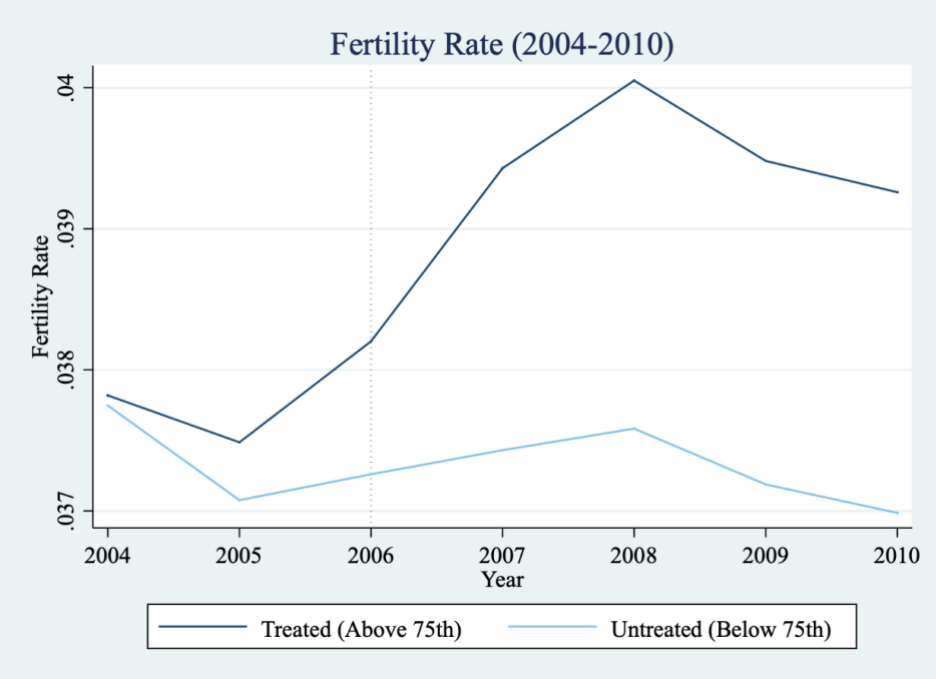
As a further test, we estimate the DiD model with a continuous treatment by excluding 2007 from the analysis. In this case births occurred in 2005 and 2006 refer to the pre-period and are compared to births occurred in 2008-2010, the post-period. The results – presented in Columns 3 and 4 of Table 8 – are robust both in the significance and in the magnitude of the coefficients and confirm our preferred estimates.

As a further informal test on the pre-treatment period, we give a simple graphical representation of the raw data. In order to compare treated and control groups, we consider again the binary treatment and we divide LMAs according to the median or the 75th percentile of the distribution of immigrants from Romania in 2006. Figure 7 depicts the fertility rate by year for the treated and control groups. In the upper panel, LMAs are divided between treated and not treated according to the median of the shares of immigrants from Romania in 2006, while in the lower panel they are separated according to the 75th percentile.

Figure 7 shows that at the beginning of the period of analysis the two groups of LMAs were on the same path and they seem to diverge after 2006 – so contemporaneously with the flows of immigrants from Romania.

Figure 7: Parallel Trends

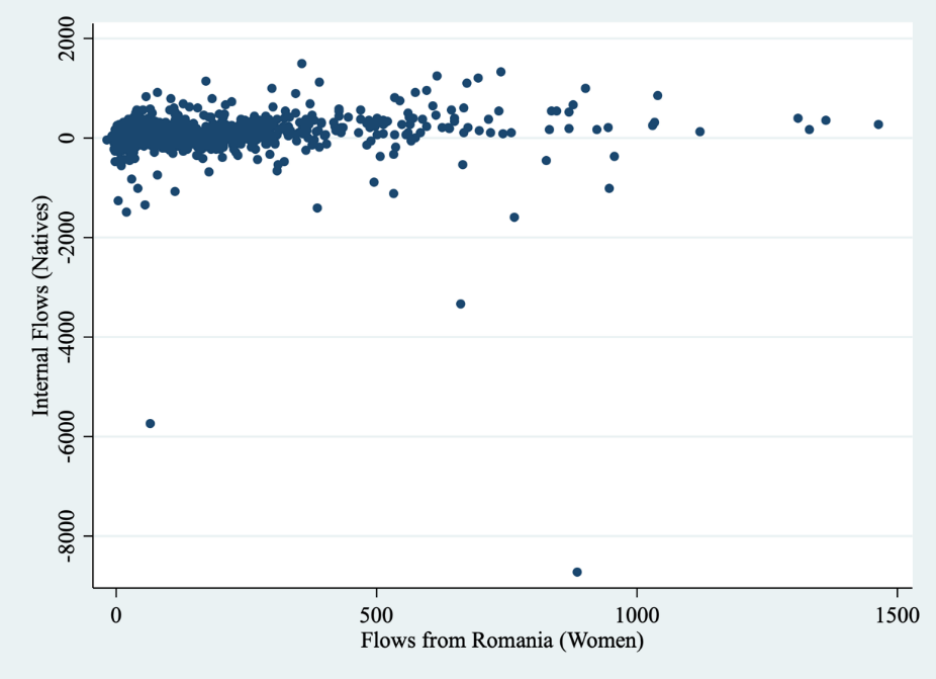




Notes: Authors' elaboration on Istat data. The graph shows the average fertility rate for treated and untreated LMAs. The former are LMAs hosting a share of immigrants from Romanian in 2006 greater than the 50th (or 75th) percentile and the latter are LMAs hosting a share of immigrants from Romanian in 2006 lesser than the 50th (or 75th) percentile.

A final concern might be relative to selective native migration. If women (and their families) desiring to have (additional) children move to areas where there is a relatively large supply of domestic service providers, this might lead to an upward bias in the estimates. In our case this does not seems to be a serious threat to the estimation. As shown in Figure 8, which plots the internal flows of natives against the flows of Romanian women from 2007 onwards, it does not appear to be any correlation between the internal flows of natives into an LMA and the arrival in the same LMA of Romanian women.

Figure 8: Correlation between Internal Native Flows and Flows from Romania (2007-2010)



Notes: Authors' elaboration on Istat data. Internal native flows are computed as inflows from other LMAs minus outflows to other LMAs. Flows of Romanian women is computed as the LMA variation in the stock of female immigrants. Observations associated to the top 1 percentile of the post-treatment distribution of immigrant flows are dropped from the graph.

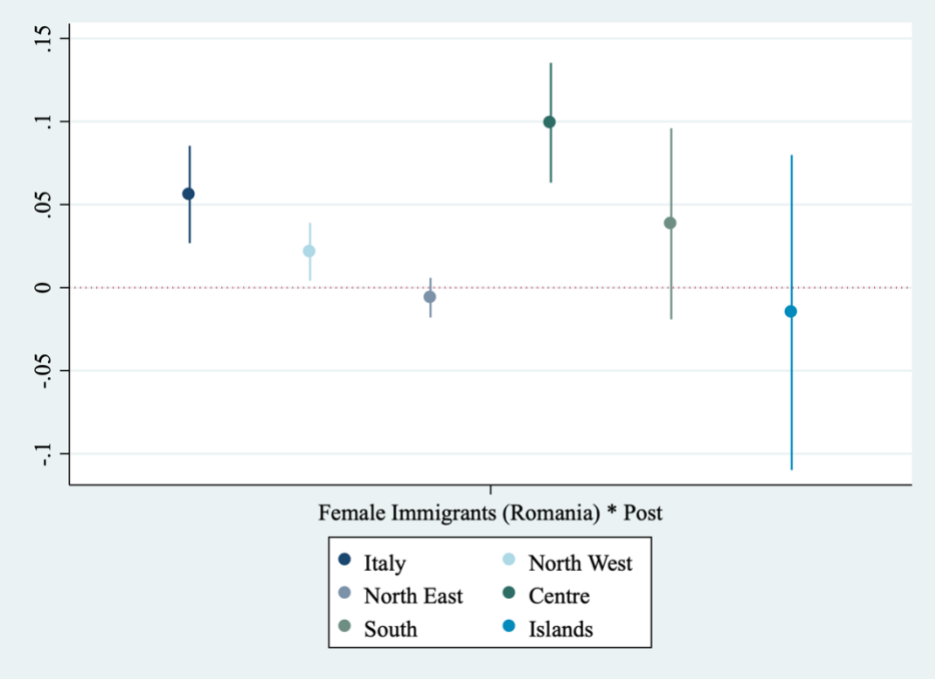
6. Heterogeneity by Area and Over Time

Italy is far from being a homogeneous country, being characterized by large cultural and economic differences. Therefore, it is of interest to assess whether the impact of immigrant flows on fertility is homogeneous across the country or, on the contrary, differentiated by area.

To this aim, we group the LMAs according to the NUTS1 classification and aggregate them into five macro areas – North East, North West, Centre, South and Islands – and we estimate separate

regressions for each of them. These areas are characterised by large differences in both labour market opportunities and immigration patterns.[25] The coefficients obtained by 2SLS estimates, presented in Figure 9 along with their standard errors, indicate that the average impact observed at national level is at closer inspection highly differentiated across the country. In fact, only in two areas – namely Centre and North West – we observe a positive impact of immigration flows on fertility: they are, not surprisingly, the areas where the flows of new immigrants are concentrated (see Figure D 2).

Figure 9: Regression Coefficients by Macroarea



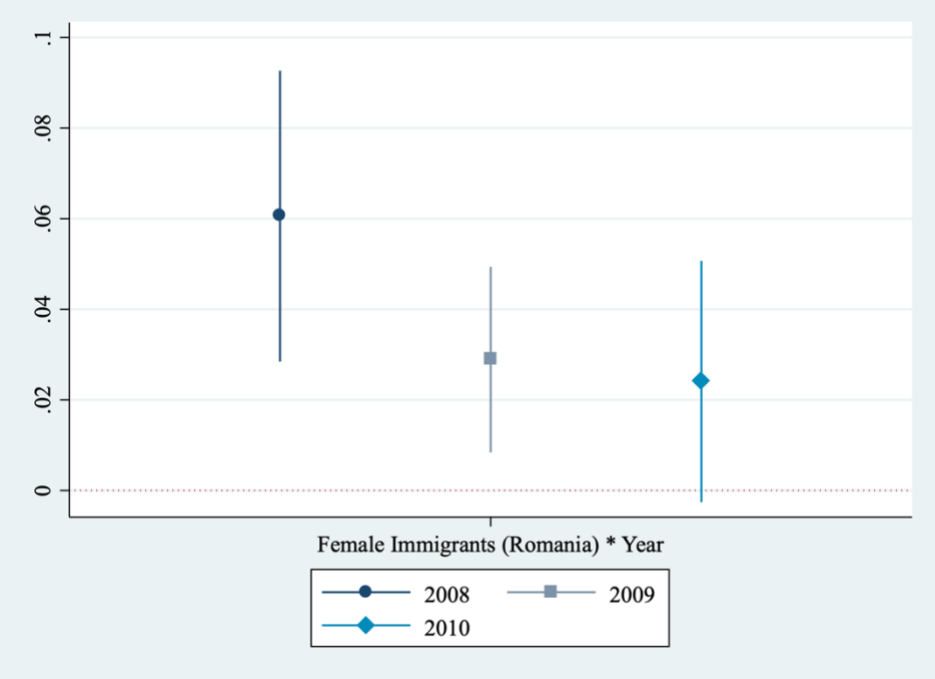
Notes: authors' elaboration on Istat data. Point estimates of 2SLS regression models by macroarea (NUTS1). See Table E 1 in Annex E for the regression outputs.

To assess the possible heterogeneity of the effect also over time, we estimate a variant of an event regression by estimating three different DiD models considering one single post-treatment year at a time. The coefficients of the flows of women from Romania are plotted in Figure 10 and show that the impact has been notably higher the year after the enlargement and declining thereafter, indicating that the effect was temporary and limited to the impact of the first large wave of immigrants.

[25] See Annex E depicting maps of the share of immigrants from Romania and the employment rate in 2006.

We also looked at possible differences in the impact by LMA size. Areas with a different population size are characterized by diverse cultural and social characteristics affecting fertility choices,[26] as well as by varying access to children relevant services. Therefore, we estimate equations 2 separately by decile of population[27] and by dividing the LMAs in three groups, characterized respectively by less than 100.000 inhabitants, less than 250.000 inhabitants and more than 250.000 inhabitants. The results, presented in Figure 11, indicate that, despite the heterogeneity of the LMAs with respect to the population size, the impact of immigrant flows on fertility has been homogeneous across areas.

Figure 10: Regression Coefficients by Year

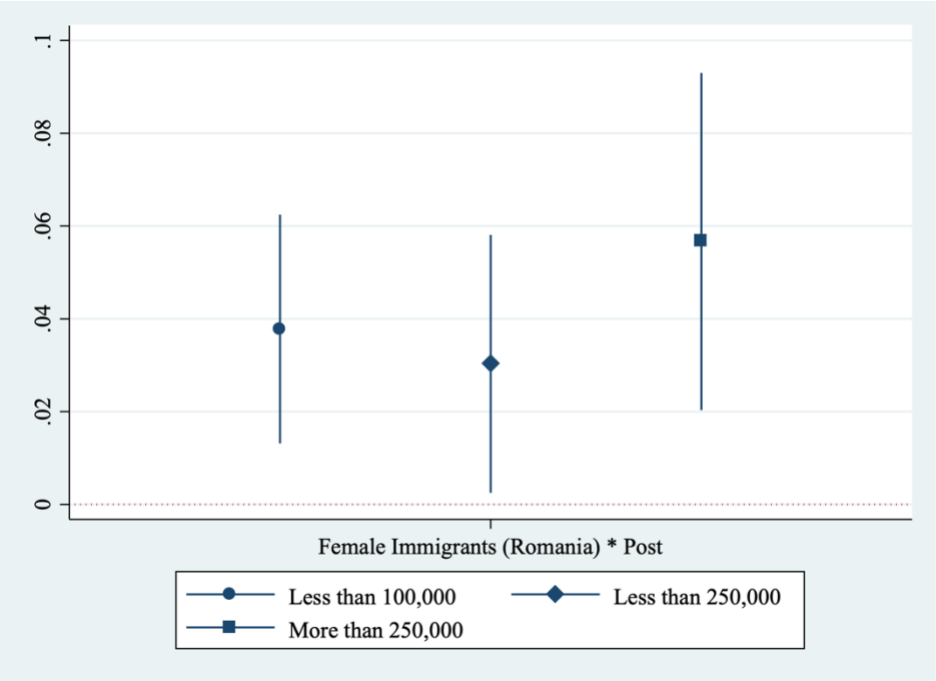


Notes: authors' elaboration on Istat data. Point estimates of 2SLS regression models by post-treatment year. See Table E 2 in Annex E for the regression outputs.

[26] This is a well-documented pattern both in a developed and in a developing context (see e.g. Wrigley, 1981; Bonneuil, 1997; Murthi et al., 1995)

[27] Results are available upon request

Figure 11: Regression Coefficients by Population Size



Notes: authors' elaboration on Istat data. Point estimates of 2SLS regression models by population size. See Table E 3 in Annex E for the regression outputs.

7. Further Results: Children's Human-Capital Accumulation

To measure children's human-capital accumulation we use data on test scores provided by the National Institute for the Evaluation of the Education and Training System (INVALSI). Each year, INVALSI runs a nationwide standardized learning test. The test, relative both to mathematics and to reading, is submitted to children enrolled in the second and fifth grade of primary school, the third grade of lower secondary school and the second grade of upper secondary school. We use the test results for the second year of primary school, which corresponds to the 2nd grade (the earliest grade for which tests are available). We corrected the test scores to take into account the possible cheating.[28] The data on test scores are available only at provincial level and, therefore, we carry out the analysis at this level of aggregation.

[28] The correction factor is calculated directly by INVALSI following Quintano et al. (2009)

In particular, we use the data for the school years from 2012/2013 – the first year a 7-year-old child born in 2005 might be enrolled in the 2nd grade[29] – to 2017/2018 – the last year for which data are available. We exclude from the analysis children born in different years than those of the main analysis and we consider only children born in Italy from native-born mothers. Furthermore, we follow the same DiD approach discussed above to assess if the same cohort of children experienced different levels of human-capital accumulation depending on their exposure to large immigration flows. The equation has been estimated by OLS because it hardly reasonable to imagine a demand-pull effect on immigrants due to the demand for human capital investment, once we have controlled for a large set of parents' background characteristics.

We use as dependent variable the test scores for both mathematics and reading, standardized so that they have zero mean and unit variance. The number of women from Romania are aggregated at the Province level and expressed as share of the Province female population aged 15-49. We include in the regressions also some students and mothers' characteristics that are shown to have an influence on the test scores by the existing literature, such as student's gender and age (in months), kindergarten and pre-primary school attendance, and mother's education level and working status. We applied the inverse hyperbolic sine transformation to the test scores and immigrant ratio, so that the estimated coefficients can be interpreted as an elasticity.[30]

The estimates of the coefficient of immigrant women from Romania are reported in column 1 of both panels of Table 9. The dependent variable in Panel A is children's test score in mathematics, the dependent variable in Panel B is children's score in reading (Italian). To allow for possible heterogeneity we have estimated the equation for children born to high- and low-skilled women (Columns 2 and 3 of both panels) and to working and not-working women (columns 4 and 5).

For the whole sample, the increase in the supply of low-skilled providers of household services appears not to have affected language learning, but to have reduced children's mathematic skills. The effects on learning are small, but not negligible – an increase of 10 p.p. in the share of Romanian women reduces test scores in mathematics by 0.2 p.p. More importantly, the effect appears to be

[29] In INVALSI dataset children enrolled in advance with respect to the regular starting age are not distinguished from those who are "on time"

[30] Regression coefficients on variables transformed with the inverse sine transformation can be interpreted identically to those obtained using the standard log transformation since $\frac{d}{dx} asinhx = \frac{1}{\sqrt{1+x^2}} \approx \frac{1}{x} = \frac{d}{dx} lnx, \forall x \geq 2$ (see Clements and Hunt, 2019 p. 836)

heterogeneous by mother's education level or working status, perhaps pointing at an indirect effect through labour-market competition.

The mechanism that drives these effects, the reason why it seems to affect only the learning process of mathematic skills and, finally, why it works heterogeneously for different mothers' characteristics surely deserves more research which is behind the scope of the present paper.

Table 9: Estimation Results of the DiD on Human Capital Accumulation of Young Children

Panel A: Mathematics					
	(1) asinh Score Full Sample	(2) asinh Score High-Skill	(3) asinh Score Low-Skill	(4) asinh Score Working	(5) asinh Score Not Working
asinh Female Immigrants (Rom) * Post	-0.0221**	-0.0172	-0.0253**	-0.0174	-0.0285***
	(0.0106)	(0.0124)	(0.0113)	(0.0110)	(0.0109)
Observations	1,299,028	364,942	934,086	947,168	351,860
R-squared	0.015	0.008	0.006	0.015	0.009
Student Controls	NO	NO	NO	NO	NO
Year FE	YES	YES	YES	YES	YES
Province FE	YES	YES	YES	YES	YES
Panel B: Reading					
	(1) asinh Score Full Sample	(2) asinh Score High-Skill	(3) asinh Score Low-Skill	(4) asinh Score Working	(5) asinh Score Not Working
asinh Female Immigrants (Rom) * Post	0.0188	0.00691	0.0225	0.0223	0.0158
	(0.0283)	(0.0306)	(0.0339)	(0.0303)	(0.0262)
Observations	1,288,552	362,431	926,121	939,076	349,476
R-squared	0.038	0.012	0.011	0.037	0.029
Student Controls	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES
Province FE	YES	YES	YES	YES	YES

Notes: authors' elaboration on INVALSI and Istat dataset. We use the inverse hyperbolic sine transformation for the number of female workers from Romania and standardized test scores. Test scores refer to children born between 2005 and 2010 and enrolled in grade 2 in the school years 2012/2013-2017/2018. Children born before 2007 (31st December) are in the pre-treatment period. Individual controls include gender, age (in months), kindergarten and pre-primary school attendance, mother's education level and working status. We exclude mother's education level when we disaggregate by skill level and we exclude the working status when we run regressions for children with working and not-working mothers separately. Robust standard errors are clustered at the Province level. * p<0.10, ** p<0.05, *** p<0.01

8. Conclusions

The availability of workers providing services that substitute or complements parental (and especially mothers') time in child rearing might reduce the cost of children and possibly increase fertility. Recently several countries have experienced large inflow of low skilled migrants specializing (also) in the provision of personal services. A few studies have been devoted to analyse the effects of immigrants providing household services on female native behaviour, concentrating mainly on the impact on labour supply. Only two studies, to our knowledge, have been focussing on fertility choices yielding contradictory results.

In this paper we provide novel evidence of the impact on native fertility of large flow of immigrants providing household services. In particular, we exploit the natural experiment generated by the unexpected opening of the Italian border in 2007 to workers coming from "new" EU countries. A large number of migrants entered Italy at that time and a many of them, especially Romanian women, worked in the personal service sector. In order to identify the causal impact of migration flows on native fertility we use an array of identifying approaches. The results obtained through the different instruments used are consistent qualitatively and quantitatively, indicating that in LMAs that received relatively more immigrants specializing in personal services the number of births increased by about 2-4 per cent, an economically meaningful impact. All the areas, independently from the population density, experienced such a positive increase in fertility. At the same time, the effect has been larger in the areas of the country where immigrants concentrated most and right after the mass arrival in 2007.

The evidence relative to the efficacy of family policies on fertility is, at most, rather inconclusive offering a large spectrum of results differentiated across the different policy interventions.[31] Also, on the more specific measures relative to the provision of child-care services, the evidence is far from univocal both qualitatively and quantitatively[32] as it is the case for the role of marketization of child care.[33] Our results indicate that access to child-care services, even if provided at market prices, does have a positive impact on fertility and, therefore, providing services that help to substitute or complement parental (still mainly maternal) child-care time represents a possible avenue to counteract the current tendency to fertility reduction in many high income countries.

[31] For a survey of the available evidence see Gauthier (2007) and Riphahn and Wiynck (2017) for recent examples

[32] See e.g. Bauernschuster et al. (2016) and Bick (2016) and the literature cited therein

[33] See e.g. Bar et al. (2018)

References

Abramitzky, R., Ager, P., Boustan, L. P., Cohen, E., & Hansen, C. W. (2019). *The Effects of Immigration on the Economy: Lessons from the 1920s Border Closure* (No. w26536). National Bureau of Economic Research.

Adamopoulou, E., & Kaya, E. (2019). *Not Just a Work Permit: EU Citizenship and the Consumption Behavior of Documented and Undocumented Immigrants*. IZA Discussion Paper No. 12642

Adao, R., Kolesár, M., & Morales, E. (2019). Shift-share designs: Theory and inference. *The Quarterly Journal of Economics*, *134*(4), 1949-2010.

Bar, M., Hazan, M., Leukhina, O., Weiss, D., & Zoabi, H. (2018). Why did rich families increase their fertility? Inequality and marketization of child care. *Journal of Economic Growth*, 23(4), 427-463.

Barone, G., & Mocetti, S. (2011). With a little help from abroad: the effect of low-skilled immigration on the female labour supply. *Labour Economics*, 18(5), 664-675.

Bartel, A. P. (1989). Where do the new US immigrants live?. *Journal of Labor Economics*, *7*(4), 371-391.

Bauernschuster, S., Hener, T., & Rainer, H. (2016). Children of a (policy) revolution: The introduction of universal child care and its effect on fertility. *Journal of the European Economic Association*, 14(4), 975-1005.

Becker, G. S., & Tomes, N. (1976). Child endowments and the quantity and quality of children. *Journal of political Economy*, 84(4, Part 2), S143-S162.

Bertrand, M., Duflo, E., & Mullainathan, S. (2004). How much should we trust differences-in-differences estimates?. *The Quarterly Journal of Economics*, 119(1), 249-275.

Bick, A. (2016). The quantitative role of child care for female labor force participation and fertility. *Journal of the European Economic Association*, 14(3), 639-668.

Bruhn, M., & McKenzie, D. (2009). In pursuit of balance: Randomization in practice in development field experiments. *American Economic Journal: Applied Economics*, 1(4), 200-232.

Card, D. (2001). Immigrant inflows, native outflows, and the local labor market impacts of higher immigration. *Journal of Labor Economics*, *19*(1), 22-64.

Cigno, A. (1991). *Economics of the Family*. Oxford: Clarendon Press.

Clemens, M. A., Lewis, E. G., & Postel, H. M. (2018). Immigration restrictions as active labor market policy: Evidence from the mexican bracero exclusion. American Economic Review, 108(6), 1468-87.

Clemens, M. A., & Hunt, J. (2019). The labor market effects of refugee waves: reconciling conflicting results. *ILR Review*, *72*(4), 818-857.

CNEL (2008). *Gli immigrati nel mercato del lavoro italiano*, Rome

Cortes, P., & Pan, J. (2013). Outsourcing household production: Foreign domestic workers and native labor supply in Hong Kong. *Journal of Labor Economics*, 31(2), 327-371.

Cortes, P., & Tessada, J. (2011). Low-skilled immigration and the labor supply of highly skilled women. *American Economic Journal: Applied Economics*, 3(3), 88-123.

D'Albis, H., Gobbi, P., & Greulich, A. (2017). Having a second child and access to childcare: Evidence from European countries. *Journal of Demographic Economics*, *83*(2), 177-210.

Forlani, E., Lodigiani, E., & Mendolicchio, C. (2015). Impact of low-skilled immigration on female labour supply. *The Scandinavian Journal of Economics*, 117(2), 452-492.

Fredriksson, A., & de Oliveira, G. M. (2019). Impact evaluation using Difference-in-Differences. *RAUSP Management Journal*.

Furtado, D. (2016). Fertility responses of high-skilled native women to immigrant inflows. *Demography*, *53*(1), 27-53.

Furtado, D., & Hock, H. (2010). Low skilled immigration and work-fertility tradeoffs among high skilled US natives. *American Economic Review*, 100(2), 224-28.

Gauthier, A. H. (2007). The impact of family policies on fertility in industrialized countries: a review of the literature. *Population Research Policy Review*, 26:323–346

Goldsmith-Pinkham, P., Sorkin, I. & Swift, H. (2020). Bartik Instruments: What, When, Why, and How. *American Economic Review*, 110 (8): 2586-2624.

Imbens, G. W., & Rubin, D. B. (2015). *Causal inference in statistics, social, and biomedical sciences*. Cambridge University Press.

Istat (2020). *Rapporto Annuale 2020. La situazione del Paese,* Rome

Jaeger, D. A., Ruist, J., & Stuhler, J. (2018). *Shift-share instruments and the impact of immigration.* National Bureau of Economic Research, No. w24285.

Llull, J. (2018). Immigration, wages, and education: A labour market equilibrium structural model. *The Review of Economic Studies*, *85*(3), 1852-1896.

Mariani, R. D., Pasquini, A. & Rosati, F. C. (2020). Elementary Facts about Immigration in Italy: What Do We Know about Immigration and Its Impact?. IZA Discussion Paper No. 13181

Mastrobuoni, G., & Pinotti, P. (2015). Legal status and the criminal activity of immigrants. *American Economic Journal: Applied Economics*, *7*(2), 175-206.

Mocetti, S., & Porello, C. (2010). How does immigration affect native internal mobility? new evidence from Italy. *Regional Science and Urban Economics*, *40*(6), 427-439.

Ortega, F., & Peri, G. (2014). Openness and income: The roles of trade and migration. *Journal of international Economics*, *92*(2), 231-251.

Peri, G. (2012). The effect of immigration on productivity: Evidence from US states. *Review of Economics and Statistics*, *94*(1), 348-358.

Ortega, F., & Peri, G. (2014). Openness and income: The roles of trade and migration. *Journal of International Economics*, *92*(2), 231-251.

Riphahn, R. T., & Wiynck, F. (2017). Fertility effects of child benefits. *Journal of Population Economics*, 30(4), 1135-1184.

Romiti, A. (2018). The effects of immigration on household services, labour supply and fertility. *Oxford Bulletin of Economics and Statistics*, *80*(4), 843-869.

Seah, K. K. (2018). The effect of immigration shocks on native fertility outcomes: evidence from a natural experiment. *IZA Journal of Development and Migration*, *8*(1), 18.

Smith, C. L. (2012). The impact of low-skilled immigration on the youth labor market. *Journal of Labor Economics*, *30*(1), 55-89.

Theoharides, C. (2020). The unintended consequences of migration policies on origin country market decision. *Journal of Development Economics*, 142.

Annex A

Table A 1: Immigration in Italy in 2006

	Immigrants (rate wrt native population)	Of which…				
		High skilled	Low skilled	Male	Female	Romania
Italy	0.046	0.104	0.795	0.432	0.568	0.098
By Macroarea						
North West	0.057	0.117	0.762	0.460	0.540	0.134
Nort East	0.069	0.088	0.824	0.424	0.576	0.073
Centre	0.055	0.113	0.779	0.419	0.581	0.145
South	0.030	0.102	0.810	0.412	0.588	0.054
Islands	0.018	0.088	0.831	0.432	0.568	0.028
By Sector						
Agriculture	0.060	0.033	0.967	0.514	0.486	0.137
Natural Resources	0.033	.	1.000	1.000	.	.
Manufacturing	0.083	0.082	0.918	0.766	0.234	0.075
Constructions	0.106	0.005	0.995	0.977	0.023	0.281
Retail Trade	0.057	0.072	0.928	0.640	0.360	0.091
Hotels and Restaurants	0.122	0.078	0.922	0.448	0.552	0.135
Transports	0.070	0.125	0.875	0.864	0.136	0.090
Finance	0.018	0.248	0.752	0.434	0.566	0.035
Services	0.055	0.200	0.800	0.392	0.608	0.105
Public Sector	0.030	0.219	0.781	0.490	0.510	0.027
Health	0.041	0.491	0.509	0.181	0.819	0.087
Personal Services	0.191	0.094	0.906	0.179	0.821	0.139

Notes: authors' elaboration on Istat data.

Table A 2: Immigration in Italy in 2007

	Immigrants (rate wrt native population)	Of which…				
		High-skilled	Low-skilled	Male	Female	Romanian
Italy	0.060	0.092	0.811	0.440	0.560	0.113
By Macroarea						
North West	0.078	0.089	0.818	0.419	0.581	0.127
Nort East	0.091	0.081	0.801	0.458	0.542	0.094
Centre	0.068	0.117	0.800	0.443	0.557	0.194
South	0.035	0.106	0.809	0.427	0.573	0.054
Islands	0.024	0.040	0.864	0.501	0.499	0.041
By Sector						
Agriculture	0.070	0.018	0.982	0.770	0.230	0.124
Natural Resources	0.024	0.147	0.853	0.853	0.147	0.147
Manufacturing	0.108	0.057	0.943	0.760	0.240	0.097
Constructions	0.152	0.042	0.958	0.988	0.012	0.239
Retail Trade	0.068	0.091	0.909	0.588	0.412	0.056
Hotels and Restaurants	0.147	0.146	0.854	0.379	0.621	0.142
Transports	0.080	0.158	0.842	0.826	0.174	0.117
Finance	0.045	0.207	0.793	0.355	0.645	0.021
Services	0.075	0.180	0.820	0.411	0.589	0.136
Public Sector	0.015	0.219	0.781	0.499	0.501	.
Health	0.038	0.414	0.586	0.163	0.837	0.117
Personal Services	0.246	0.158	0.842	0.205	0.795	0.124

Notes: authors' elaboration on Istat data.

Table A 3: Sample Means

	Overall	Above 50^{th}	Below 50^{th}	Above 75^{th}	Below 75^{th}	Pre Policy	Post Policy
Shares (2006)	0.002	0.003	0.000	0.006	0.000	0.002	0.002
Stock (Romania)	462	857	67	1480	125	251	674
Flow (Romania)	106	189	23	314	37	49	163
Births	819	1 316	323	1 919	454	824	815
Native Women (15-49)	20 818	33 134	8 502	47 658	11 911	21 091	20 546
Observations	3660	1830	1830	912	2748	1830	1830

Notes: authors' elaboration on Istat data.

Annex B

Table B 1: Interaction Between 2006-Shares and Yearly Dummies

	(1) Births
Share (2006) * 2005	-3,624
	(2,418)
Share (2006) * 2006	2,405
	(2,328)
Share (2006) * 2007	1,841
	(3,990)
Share (2006) * 2008	16,333***
	(4,557)
Share (2006) * 2009	9,226*
	(5,429)
Share (2006) * 2010	9,094
	(6,752)
Native Women (15-49)	0.0562**
	(0.0222)
Observations	4,263
R-squared	0.999
Controls	YES
Year FE	YES
LMA FE	YES

Notes: authors' elaboration on Istat data. Robust standard errors are clustered at the LMA level.
* p<0.10, ** p<0.05, *** p<0.01

Table B 2: Epps-Singleton Two-Sample Empirical Characteristic Function Test

Group variable	Treatment period
Test statistic W2	**118.376**
Null hypothesis	distributions are identical
P-value	0.000
Critical value at .10	7.779
Critical value at .05	9.488
Critical value at .01	13.277

Notes: Authors' elaboration on Istat data.

Table B 3: Dickey-Fuller Test for Unit Root

	(1) Stocks	(2) Δ Stocks	(3) Births	(4) Δ Births
DF Test	121.63	1465.59	662.74	2082.99
P-Value	1.00	0.00	1.00	0.00

Notes: authors' elaboration on Istat data. DF Test is the augmented Dickey-Fuller test (1 lags).

Annex C

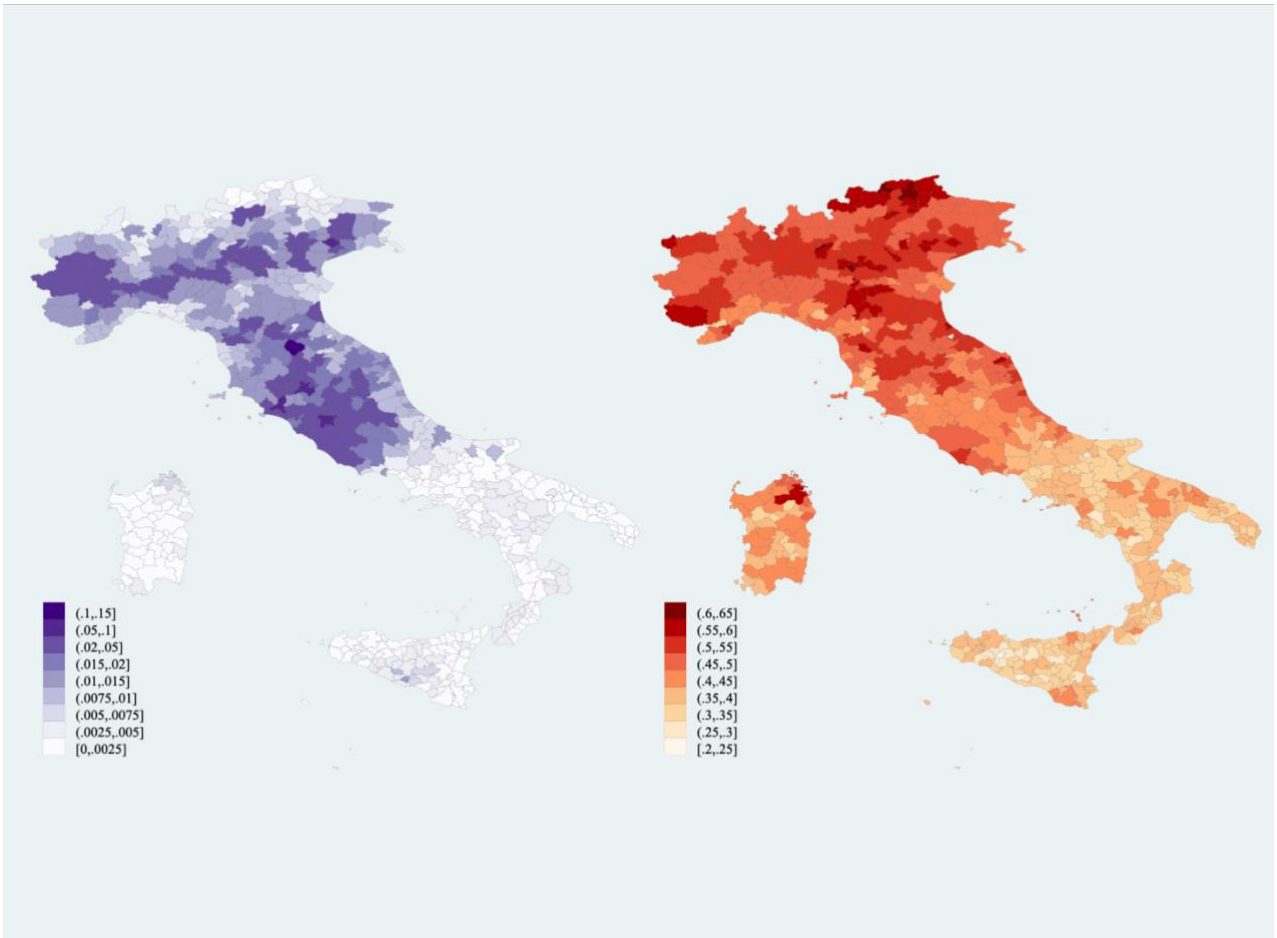
Table C 1: First-Stage Regressions

	(1) Network Instrument Immigrants	(2) Distance Instrument Immigrants
Instrument * Post	1.64***	-0.00***
	(11.37)	(-4.06)
Native Women (15-49)	-0.65*	-0.99**
	(-2.37)	(-2.67)
Child-Care Services (2006)	0.00**	0.01**
	(2.69)	(3.05)
Per Capita Income (2006)	-0.24***	-0.25**
	(-3.41)	(-3.07)
Employment Rate (2006)	-653.03*	-974.22**
	(-2.50)	(-2.82)
Share of Women 15-24	253.23	1434.94
	(0.09)	(0.34)
Share of Women 25-34	-7213.13*	-5317.31
	(-2.36)	(-1.22)
Share of Women 35-44	-1804.66	-910.27
	(-0.47)	(-0.19)
Observations	3654	3654

Notes: authors' elaboration on Istat data. Column (1) refers to the First-stage regression of the shift-share instrument model. Column (2) refers to the First-stage regression of the distance instrument model. * p<0.10, ** p<0.05, *** p<0.01

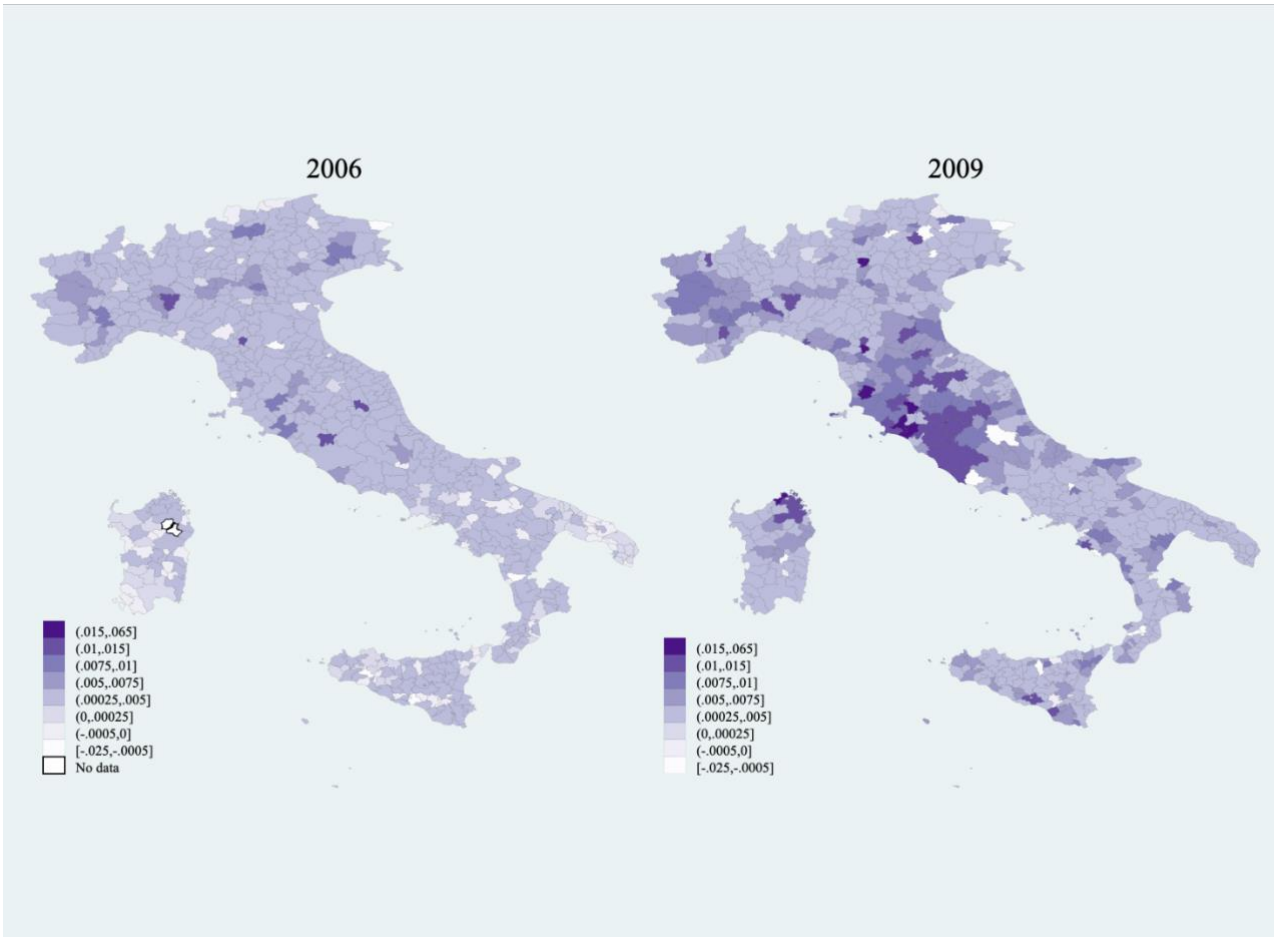
Annex D

Figure D 1: Immigration and Employment Rate in 2006



Notes: authors' elaboration on Istat data. The left-hand map shows the shares of immigrants from Romania in 2006. The right-hand map shows the employment rate in 2006.

Figure D 2: Romanian Inflows by LMA (2006-2009)



Notes: authors' elaboration on Istat data. The immigrant flows by LMAs are divided by the native female population of the same year. Migrant inflows are measured in the pre-treatment year (2006) and at the end of the period (2009).

Annex E

Table E 1: DiD Estimation with a Continuous Treatment by Macroarea

	(1) Baseline	(2) North West	(3) North East	(4) Centre	(5) South	(6) Island
Flow (Rom) * Post	0.0578*** (0.0173)	0.0203** (0.00854)	-0.00450 (0.00607)	0.106*** (0.0167)	0.0148 (0.0379)	0.0445 (0.0536)
Observations	3,654	636	714	630	1,014	660
R-squared	0.061	0.621	0.919	0.634	0.752	0.181
Controls	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
LLM FE	YES	YES	YES	YES	YES	YES
F Stat	129.165	747.592	151.256	49.441	198.214	86.983

Notes: authors' elaboration on Istat dataset. Controls include the number of native women (15-49), age-specific population shares, per capita income, child-care services and the employment rate in 2006. Robust standard errors are clustered at the LMA level. * p<0.10, ** p<0.05, *** p<0.01

Table E 2: DiD Estimation with a Continuous Treatment by Year

	(1) Baseline	(2) 2008	(3) 2009	(4) 2010
Flow (Rom) * Post	0.0560*** (0.0150)	0.0603*** (0.0164)	0.0287*** (0.0104)	0.0237* (0.0134)
Observations	4,263	2,436	2,436	2,436
R-squared	0.202	0.339	0.349	0.387
Controls	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
LLM FE	YES	YES	YES	YES
F Stat	155.791	634.509	6773.088	937.539

Notes: authors' elaboration on Istat dataset. Controls include the number of native women (15-49), age-specific population shares, per capita income, child-care services and the employment rate in 2006. Robust standard errors are clustered at the LMA level. * p<0.10, ** p<0.05, *** p<0.01

Table E 3: D-i-D Estimation with Continuous Treatment by Population Size

	(1) Baseline	(2) Less 100	(3) Less 250	(4) More 250
Flow (Rom) * Post	0.0578*** (0.0173)	0.0378*** (0.0126)	0.0303** (0.0142)	0.0567*** (0.0185)
Observations	3,654	2,886	522	246
R-squared	0.061	0.096	0.485	0.919
Controls	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
LLM FE	YES	YES	YES	YES
F Stat	129.165	404.548	310.940	117.758

Notes: authors' elaboration on Istat dataset. Controls include the number of native women (15-49), and the public expenditure in services to childhood and the employment rate in 2006 interacted with time trend. Robust standard errors are clustered at the LMA level. * p<0.10, ** p<0.05, *** p<0.01