From Pink-Collar to STEM fields. Cultural Persistence and Diffusion of Socialist Gender Norms*

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Abstract

The fall of the Iron Curtain in 1989 led to a mass wave of migration from the Former Soviet Union (FSU) to Israel. We document the persistence and transmission of the Soviet unconventional gender norms, both vertically across generations of immigrants, and horizontally through neighborhood and school peer effects. We follow an entire cohort of Israeli girls throughout their educational and occupational choices. Among young Israeli women who immigrated as infants from the FSU, we identify the persistence of two important features of the Soviet culture: the prioritization of science and technology, and the strong female attachment to paid-work. In high school, these women are significantly more likely than natives and other immigrants to major in STEM. In tertiary education, they remain over-represented in STEM, but also differ significantly from other women by their specific avoidance of study fields leading to "pink collar" jobs, such as education and social work. They also display a specific choice of work-life balance reflecting a greater commitment to paid-work. Finally, the choice patterns of native women shift towards STEM and away from traditional female study fields as the share of FSU immigrants in their lower-secondary school increases.

Keywords: culture, gender norms, education, STEM, occupational choice, immigration, Soviet Union, Israel

JEL Classification Numbers: Z1, I21, J16, J24, P30

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1 Introduction

Despite the convergence of male and female labor force participation and women overtaking men in educational attainment, occupational segregation persists and women are still under-represented in high-paying and competitive occupations (Blau and Kahn, 2017; Cortes and Pan, 2018). Part of the explanation certainly lies with cultural norms and identity. Cultural economics has established that the beliefs, preferences and attitudes of a group could persist over time and be transmitted across generations, even after the grounds on which they formed in the first place, such as institutions, regulations, or markets, have disappeared.[1] In this paper we identify a specific culture where occupational gender segregation has been partly undone using the natural experiment constituted by the sudden massive Jewish immigration from the Former Soviet Union (FSU) to Israel in the early 1990's.[2] Analyzing the educational and occupational choices of young Israeli women depending on their origin, we document the vertical persistence and horizontal diffusion of Soviet culture in two main dimensions : the valorization of Science, Technology, Engineering and Mathematics (STEM) and female attachment to paid-work.

We use a rich longitudinal administrative data, tracking students' educational achievement and choices from middle school through tertiary education, and follow a synthetic cohort of female students born in 1988 and 1989, of which nearly 15% were born in the FSU and 4% in other countries.[3] These FSU immigrants, while born abroad, arrived in Israel as infants or young children, and were exposed to the same institutional setting as natives and other immigrants throughout the educational pipeline and in the labor market. We use the tests scores taken by the entire population of this cohort in eight grade (GEMS) in order to capture any differences in

[1]The vertical durability of culturally inherited attitudes has been illustrated, inter alia, in the domain of violence (Grosjean, 2014), political attitudes (Alesina and Fuchs-Schündeln, 2007), time preference and trust (Algan and Cahuc, 2010; Alesina *et al.*, 2013), development (Ashraf and Galor, 2013; Spolaore and Wacziarg, 2013), and gender norms (Giuliano, 2007; Fernández and Fogli, 2009; Lippmann *et al.*, 2019).

[2]After the fall of the Iron Curtain in 1989, over 800,000 immigrants arrived in Israel, whose population at that time was around 4,5 million, within the span of 5 years.

[3]In appendix, Table A1 shows that of the immigrants from former Communist countries, only 1.4% were born in formerly socialist Central European countries outside of the Soviet Union. For brevity, we hereafter refer to the whole group as FSU immigrants.

skills, family and social environment across students.[4] These tests predate any track or study field choices. We use them as an anchor in order isolate the influence of culture on students' subsequent choice of study fields.

FSU immigrant girls show a particularly marked preference for STEM subjects in high school compared both to natives and other immigrants. This holds, notwithstanding their early achievement as measured in eight grade, their parents' education or their family socio-economic background. In tertiary education, they remain over-represented in STEM but also move into other fields, such as business. But most strikingly, they do not follow the general overwhelming female self-selection into study fields leading to "pink-collar" occupations, such as education and social work. Using the National Income and the Labor Force Surveys, we complement these findings by describing the allocation of native, FSU immigrant and other immigrant women into different occupations. It turns out that FSU immigrant women exhibit stronger labor force attachment, as shown by their higher employment rate, longer working hours and selection into occupations characterized by higher wages.

These findings suggest that women from the FSU base their study-field choices in view of the labor market, rather than their role as a mother or a wife, to a much greater extent that other native or immigrant women in Israel do. In doing so, they continue to express the Soviet gender norms, despite their full exposure to the Israeli education system and labor market. In turn, we find that these norms diffuse into the choices of native-born young women who attended lower secondary schools with high concentrations of immigrants from the FSU. This convergence takes place in spite of the lower socio-economic background of the pupils who attend such schools, which, as a rule, is detrimental to demanding educational investments such as mathematics and STEM.

Our findings contribute to three current lines of research. The first contribution is to the analysis of determinants of women's occupational choices, especially among women with higher education. In many industrialized countries, these choice patterns are characterized by two main stylized facts: female under-representation in high income, hours intensive occupations such as in STEM

[4]Israel's Growth and Effectiveness Measures for Schools (GEMS) include four tests in Hebrew language arts, mathematics, science and technology, and English.

fields and over-representation in lower-wage, less time intensive occupations such as teaching.[5] Recent literature has focused on estimating gender differences in preferences vis-à-vis the content matter of occupations and job characteristics. Cortes and Pan (2018) in a review of the literature on gender occupational segregation, highlight the importance of differences in preferences for occupational characteristics- such as family-friendliness or preferences for "work with people rather than things".[6] Our analysis, identifying differences in choice behavior across culturally distinct groups of women high lights the fact, that these "female" preferences are themselves culturally conditioned as suggested by Akerlof and Kranton (2000). Moreover, the relationship between the concentration of FSU immigrants and choice patterns of native indicates that these preferences, while persistent, are not fully fixed, but rather depend on social context.

The second contribution of the paper with respect to cultural economics, where we provide empirical evidence on both vertical and horizontal diffusion, as proposed by Bisin and Verdier (2011). Our findings agree with the large body of literature identifying the persistence of social norms inculcated during the socialist era in Eastern Europe, years after the socialist institutions have been long gone. We expand this literature by showing evidence not only of the persistence of such norms among descendants of those who experienced these regimes but also diffusion among other groups with whom they come in contact. Close to our work, a recent article by Jarotschkin and Zhuravskaya (2019) illustrates how the initial gender norms of Germans and Chechens, who were deported from the Western parts of the USSR to Central Asia and Siberia, have been durably modified by the exposure to that of local populations. A recent paper by Schmitz and Weinhardt (2019) documents how the migration of East Germans to Western regions after 1989 has modified the gender norm of West German couples, in particular as concerns the labor market participation of women. Finally, while there is a large body of literature documenting the persistence of

[5]Women's under-representation in STEM occupation, particularly engineering and information technology (Blau and Kahn, 2017) is visible in their early human capital investment, especially in mathematically intensive study fields—such as physics and computer science—in secondary and tertiary education (Turner and Bowen, 1999; Riegle-Crumb *et al.*, 2012; Buser *et al.*, 2014; Friedman-Sokuler and Justman, 2016; Justman and Méndez, 2018; Rapoport and Thibout, 2018).

[6]Several researchers find that the lower returns are related to marriages market payoffs and family responsibilities (Chiappori *et al.*, 2018; Kleven *et al.*, 2019)

culturally conditioned gender norms on female labor force participation and fertility choices, we are the first to examine the persistence with respect to gender norms in occupational choices.

Finally, our findings relate to a growing literature on the effect of immigration on educational outcomes of natives. Within the large literature dedicated to peer effects in the classroom, several studies have focused on acculturation effects across ethnic groups at school (Cutler and Glaeser, 1997; Hoxby, 2000; Card and Rothstein, 2007). Our work complements that of Gould *et al.* (2009) who illustrate how the achievements of socially disadvantaged native Israeli children can be negatively affected (in terms of dropout rates and college attendance) by the influence of immigrant schoolmates with lower socio-economic background. While our findings confirm this observation, they also show that exposure to immigrants may offer natives an opportunity to relax traditional gender norms.

The paper proceeds as follows: section 2 describes the institutional setting and the data used; section 3 analyzes the achievement and choice patterns of native, FSU immigrant, and other immigrant young women, throughout the educational pipeline to the labor market; section 4 analyzes the effect of FSU immigrant concentration on natives; and section 5 concludes.

2 Background and data

During the socialist episode, countries of Central and Eastern Europe have developed, for 45 to 70 years, a culture of scientific and technical progress. The priority given to science and engineering within education and research (Alesina and Fuchs-Schündeln, 2007) paralleled that of the military-industrial sector within the economy; both were instrumental in the economic competition and arms race with the Western capitalist world, in particular the United States (Graham, 1993). These countries also developed institutions aimed at promoting full employment (and fertility) of both men and women, harnessed to the objective of rapid industrial growth. Since 1970 onward, women constantly made up half of the Soviet labor force (51%), and about 60% of skilled workers owing an average or higher level of education (Goskomstat 1989,

1990). As underlined in the 1989 Soviet statistical yearbook, even physically difficult occupations comprised as much as 20% of female workers; 25% for the construction sector for example. This involvement in the labor market, in turn, influenced the work values of women, and, more generally, modified the conception of gender roles and identity. The persisting legacy of these attitudes and their consequences in terms of labor market participation, school performance, and family arrangements, has been documented in several studies, in particular in the framework of the specific episode of division and reunification of Germany (Cooke, 2007; Bauernschuster and Rainer, 2012; Görges and Beblo, 2015; Campa and Serafinelli, 2018; Lippmann and Senik, 2018; Lippmann *et al.*, 2019). A similar 'natural experiment' took place when the unexpected collapse of the Soviet regime led to a dramatic change in the country's emigration policy, which suddenly permitted its citizens to emigrate freely. In particular, Jews were given the possibility to migrate to Israel without restriction, a possibility that an overwhelming majority of them actually used ((Cohen-Goldner and Eckstein, 2010), (Konstantinov, 2005), Cohen-Goldner *et al.* (2015)). This creates the conditions for studying the cultural persistence and diffusion of Soviet-type gender norms.

2.1 Educational data and descriptive statistics

We use administrative data to follow two full cohorts of eighth-grade students in 2002 and 2003, born in 1988-1989, through high school and tertiary education.[7] Within these cohorts, FSU immigrants majoritarily arrived before the age of six, which is the school starting age in Israel, hence were exposed to the same institutional setting as natives and other immigrants throughout the educational pipeline and in the labor market.[8] Our longitudinal data set contains individual

[7]The sources of data for our analysis are several administrative data sets merged for our study by Israel's Central Bureau of Statistics using national Identity Numbers: the Population Registry; Ministry of Education's registry of students enrolled in 8th-grade in two consecutive school years, 2001/2 and 2002/3 (we refer to them in what follows as 2002 and 2003); the Ministry of Education's matriculation records of students enrolled in 12th grade in 2005/6 and 2006/7; Israeli Central Bureau for Statistic's registry of higher education; National Institute for Testing and Evaluation Psychometric database; and Tax Authority database.

[8]We perform the same analyses limiting our immigrant sample to those who immigrated prior to 1995 and results remain qualitatively unchanged.

level data on: family socio-economic characteristics; municipality of residence; middle and high school characteristics; eighth grade achievement; twelfth grade attainment measures; matriculation study fields and scores; and tertiary education application preferences and entrance scores, study field, and degree completion. We identify immigrant students by their country of birth as recorded in the Population Registry.

For the purpose of this analysis, our synthetic cohort is comprised only of female students attending Hebrew-language schools, the vast majority of them were born in 1987 to 1990. Our measure of individual eighth-grade achievement is taken from Israel's Growth and Effectiveness Measures for Schools (GEMS, "meitzav" in Hebrew), a set of four standardized tests in Hebrew language, mathematics, science and technology, and English. In 2002 and 2003 all schools in Israel with an eighth grade, except most ultra-orthodox schools, were split into two balanced samples of equal size, with half the schools participating in GEMS tests in 2002 and the other half in 2003. Our synthetic cohort is a composite of these two half-cohorts of eighth grade students, which is representative of the full population of schools. We limit our study sample from the synthetic cohort to students who have at least two of the four GEMS scores, and information on at least one of the parents' education.[9] This leaves us with a study sample of 30,729 students, of whom 18.4% are immigrants.

Table 1 presents descriptive statistics of individual characteristics of the three origin groups in eighth grade: natives, FSU immigrants and other immigrants. The average income level is similar across the two groups of immigrants, and lower than that of native students' families (panel (a)). With respect to parents' education, fathers' years of education are slightly higher on average among immigrants compared to natives. However, the two immigrant group diverge with respect to maternal education— mothers of FSU immigrants are significantly more educated compared both to natives and other immigrants, reflecting the higher level of female education in the FSU. FSU immigrants outperform native students in Mathematics and English and are the lowest performers

[9]We impute missing GEMS scores by regressing each GEMS score on the other scores and on all available background characteristics for students with all scores, and use the regression to predict missing scores. Adding school fixed effects made little difference to the imputed values.

in Hebrew language (panel (b)). All differences in achievement between groups are statistically significant at the 1% level, except the differences in English. Figure 1 plots the distribution of eighth grade achievement by origin: immigrants from the FSU are over-represented at the top of the achievement distribution in mathematics and science, and together with other immigrants at the bottom of the distribution in Hebrew language achievement.

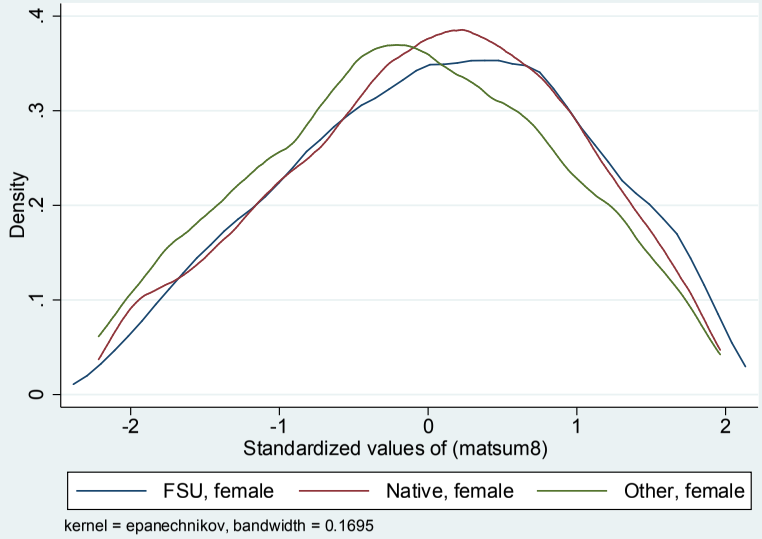
Table 1: Descriptive statistics- family SES measures and scores in eighth grade

	FSU	**Native**	**Other**		**FSU**	**Native**	**Other**
(a) Demographics				(b) Eight grade achievement			
Year of birth				Mathematics	54.87	53.44	49.66
1986	0.01	0.00	0.01		23.6	23.06	23.61
1987	0.15	0.06	0.09	Science	63.7	65.05	62.03
1988	0.47	0.49	0.47		19.81	17.3	18.83
1989	0.36	0.44	0.42	Hebrew	62.99	69.34	63.95
1990 or more	0.00	0.00	0.01		21.71	16.73	20.42
Family income quintile				English	81.62	81.04	82.65
Lowest	0.14	0.11	0.27		19.08	18.97	19.49
Second	0.28	0.15	0.21	(c) Secondary education outcomes			
Third	0.30	0.20	0.16	Retention	0.89	0.97	0.93
Fourth	0.21	0.25	0.13	Matriculated	0.61	0.70	0.63
Highest	0.07	0.29	0.22	*Matricultaion scores (weighted)*			
Parents' maximal schooling				Mathematics	68.38	76.76	71.87
<12	0.19	0.12	0.23		38.75	34.66	37.00
12	0.20	0.41	0.21	Hebrew	60.59	69.08	64.98
13-15	0.34	0.21	0.17		31.83	25.87	29.11
15<	0.26	0.27	0.39	English	53.80	56.99	58.93
Father's education	13.13	13.01	13.19		31.71	28.18	32.04
	2.84	3.03	4.99	(d) Tertiary education application			
Mother's education	13.35	13.12	12.82	Psychometric test	0.55	0.56	0.53
	2.69	2.78	4.55	Applied	0.50	0.58	0.55
				Psychometric scores			
				Mathematics	107.94	111.76	107.99
					19.12	18.74	19.27
				Hebrew	102.66	112.7	106.97
					20.48	19.31	21.16
N	4458	25054	1283	English	110.45	109.29	115.98
%	0.14	0.81	0.04		22.83	23.71	23.84

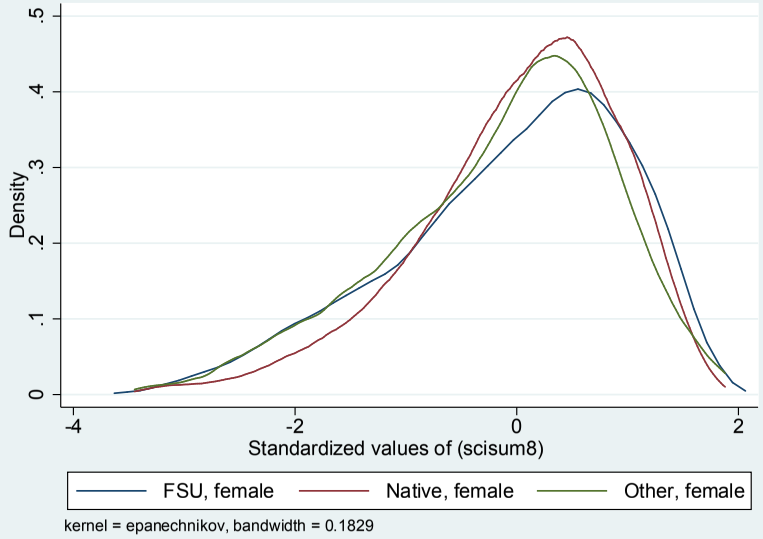
Our next measure is taken in a later point in time, at the end of high school, around age 18. The first indicator at this stage is whether a student enrolled in twelfth-grade or not (panel (c)

Figure 1: Distribution of students by origin and eighth grade achievement (standardized)

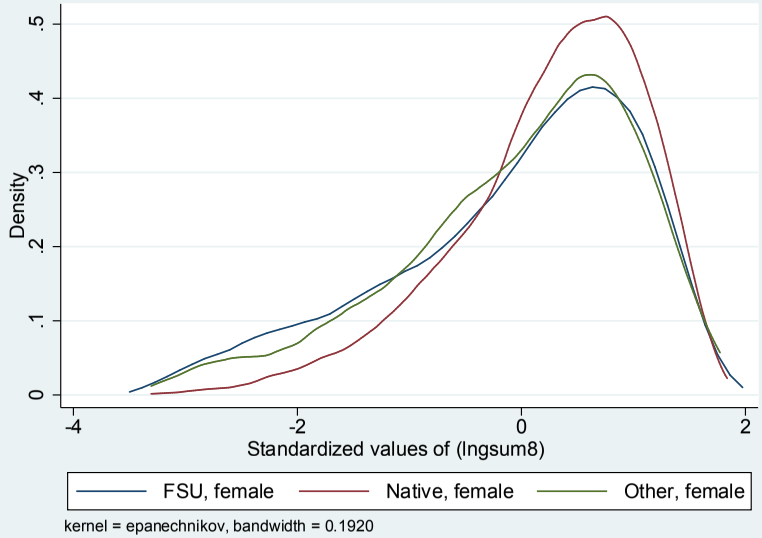
(a) Mathematics



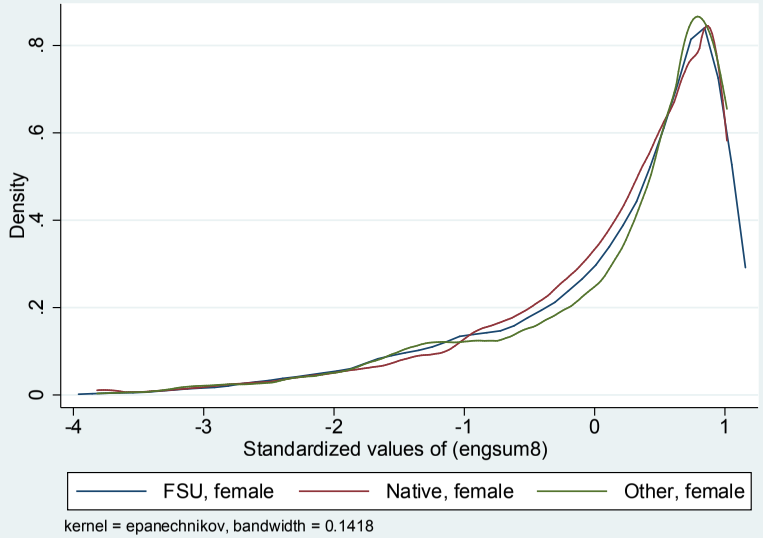
(b) Science



(c) Hebrew



(d) English



Notes:Each graph represent the density function of achievement in the four domains for each origin group.

of table 1): FSU immigrants dropout at higher rates than the other groups. To gain access to higher education, students in Israel must obtain a matriculation certificate which includes both mandatory and elective study fields. It turns out that matriculation rates are lower for FSU immigrants compared to the other two groups.[10] The second prerequisite for admission to most tertiary programs is the psychometric exam (similar to the SAT in the United States).[11] While FSU immigrants take this exam at a similar rate as natives, and higher than other immigrants, their propensity to apply to higher education is significantly lower than other groups (panel (d)). This may reflect a combination of lower socio-economic background and higher propensity to go study abroad.

Our main outcomes of interest are the choices of field of study in high school and tertiary education (Figure 2). In high school, students may choose any number of electives, usually take between 1 and 3 subjects, and generally face no constraint on the combination thereof [12]. In tertiary education, students apply to specific majors, with combinations usually within field, e.g. economics and psychology that both belong in social sciences. The relationship between occupational choice and field of study is strong at the tertiary level and less so in the secondary level. For example, taking STEM matriculation electives may increase the likelihood of admission into some tertiary STEM programs, but not all, while the content of many bachelor degrees, such as nursing, engineering and teaching, is strongly related to specific occupations and their labor market skills and knowledge (Central Bureau of Statistics, 2009).

Panel (a) of Figure 2 displays the choice of matriculation elective in high school by those who are still in school in twelfth grade. Much fever young women from the FSU take humanities, art and social science, as compared with both natives and other immigrants, but they choose biology,

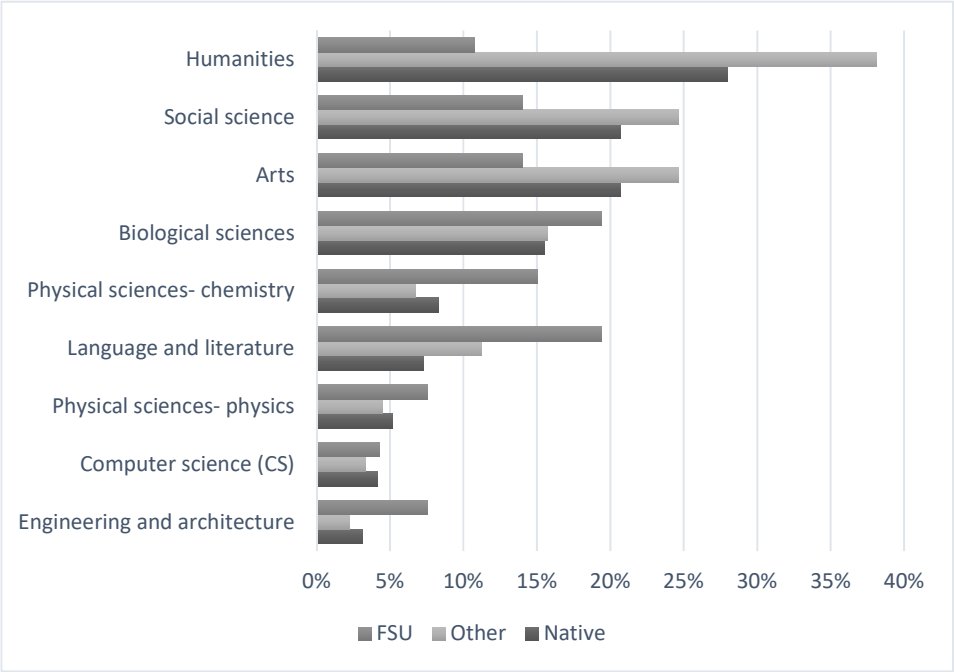
[10]Full matriculation entails achieving a passing score in seven basic-level mandatory subjects as well as a passing score in at least one advanced-level elective, but students can and often do take two or more electives. Levels of difficulty are represented as numbers of units studied in a subject, generally between one and five. Basic-level mandatory subjects are: 3 units mathematics, 3 units English, 2 units language arts (Hebrew), 2 units history, 2 units Bible studies, 2 units literature and 2 units civics. Any of these subjects can be taken as an advanced elective at the 5 unit level. There are over 50 potential elective subjects available to students; the most popular are: biological and physical sciences, computer science, social sciences, languages (mainly Arabic and French), geography and art.

[11]The test, including the language skills section, can be taken in a wide variety of languages, including Russian.

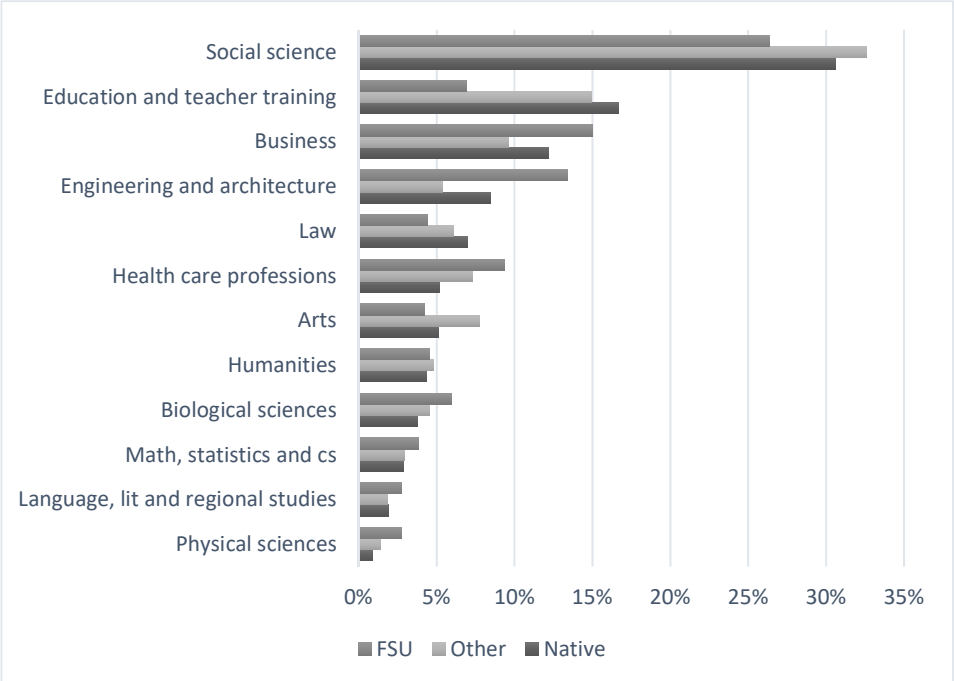
[12]Some schools offer set programs with specific combinations such as physics and computer science or dance and theater, but these combination vary widely across schools.

Figure 2: Choice of study field in secondary and tertiary education, by origin

(a) Matriculation elective



(b) Tertiary study fields



Notes:

chemistry, physics and engineering much more often than the other groups. FSU students also more often take language and literature electives at higher rates, but this is mainly driven by the choice of matriculation elective in Russian language. Panel (b) of Figure 2 illustrates the choice of students in terms of primary field of study in tertiary education, among those enrolled in tertiary education. In tertiary education, women who were born in the FSU are over-represented in all STEM fields, as well as in business and health care professions and are under-represented in education and law. While these patterns may seem to indicate selection according to linguistic intensity, this pattern is not found among women born in other countries outside Israel. The difference between the two types of immigrants is especially salient with respect to education and engineering. FSU immigrant young women are over-represented in tertiary STEM study fields, and substantially under-represented in education and teacher training.

3 The persistence of Soviet gender norms among immigrants

We analyze the different choice behavior of three groups, who potentially have distinct gender norms: native born, FSU born, and other immigrant Israelis.[13] Equation 1 describes outcome y of individual i in origin group $j = FSU, Native, Other$ in school s as a function of individual characteristics, prior achievement, and prior choice.

$$\begin{aligned} y_{ijst} &= \beta_j + X_i\theta_j + \sum_{a=0}^{t-1} A_{ia}\gamma_{ja} + y_{it-1}\delta_j + u_{ijst} \\ u_{ijst} &= \omega_{jc} + \sum_{a=1}^{t} \omega_{jsa} + \epsilon_{ijs} \end{aligned} \tag{1}$$

Each outcome is observed at time $t = 1, 2, 3, 4$ corresponding to the four stages in the educational pipeline: eighth grade, end of high school, application to tertiary education and tertiary education. The coefficient of interest in Equation 1 is β_j, the difference across groups j in terms of outcome, either achievement or choice propensity, conditional on: SES indicators—parental

[13]The main effect of immigration is lower levels of language (Hebrew) proficiency compared to natives—a trait which is common to all immigrants as shown in Figure 1.

education and family income, X_i; measures of achievement at prior stages A_{ia};[14] and, when relevant, earlier choices y_{it-1}. All coefficients are indexed j and vary by origin. The second equation in 1 decomposes the error term u_{ijst} into three components: a cohort fixed-effect ω_{jc} (capturing the potential difference in testing regimes between the two cohorts that comprise our synthetic cohort); a school fixed-effect ω_{js} (capturing potential environmental factors affecting achievement or choice of students in a school);[15] and ϵ_{ijs} - a random error clustered at the school level. Controlling for the socio-economic background of parents is important as in the case of FSU migrants, we expect two countervailing effects: the negative influence of being a migrant (hence lower SES) on school performance and attraction to STEM, and the positive influence of Soviet origin on the same outcomes. Also, in all of our analyse of educational choices, we control for the math scores obtained by students in eight grade. This is not only in order to control for their own math skills, but also to capture the potential human capital of parents that may influence such early performance, and may be poorly measured by their education and income in case they are immigrants.

3.1 Matriculation electives choice in secondary education

We begin with a non-parametric approach and examine the proportion of students choosing matriculation electives as a function of eighth grade mathematics achievement. Figure 3 reveals that the choice patterns of FSU students differ substantially from those of other young women. We know that FSU immigrant are more likely to take STEM matriculation electives and are over-represented in the higher deciles of mathematics achievement. But the figure shows that their marginal propensity to choose STEM electives is higher than that of natives and other immigrants, irrespective of their early math achievement. This rules our the suspicion that the drive of FSU

[14] Achievement measures are: a second degree orthogonalized polynomial of the four GEMS scores (mathematics, science, Hebrew and English); matriculation scores in three main mandatory subjects—mathematics, Hebrew and English—weighted by difficulty level; and psychometric exam scores in the same three domains.

[15] In section 4 we look into this element separately.

young women towards STEM is driven by the upper tail of the math skills distribution among this group.

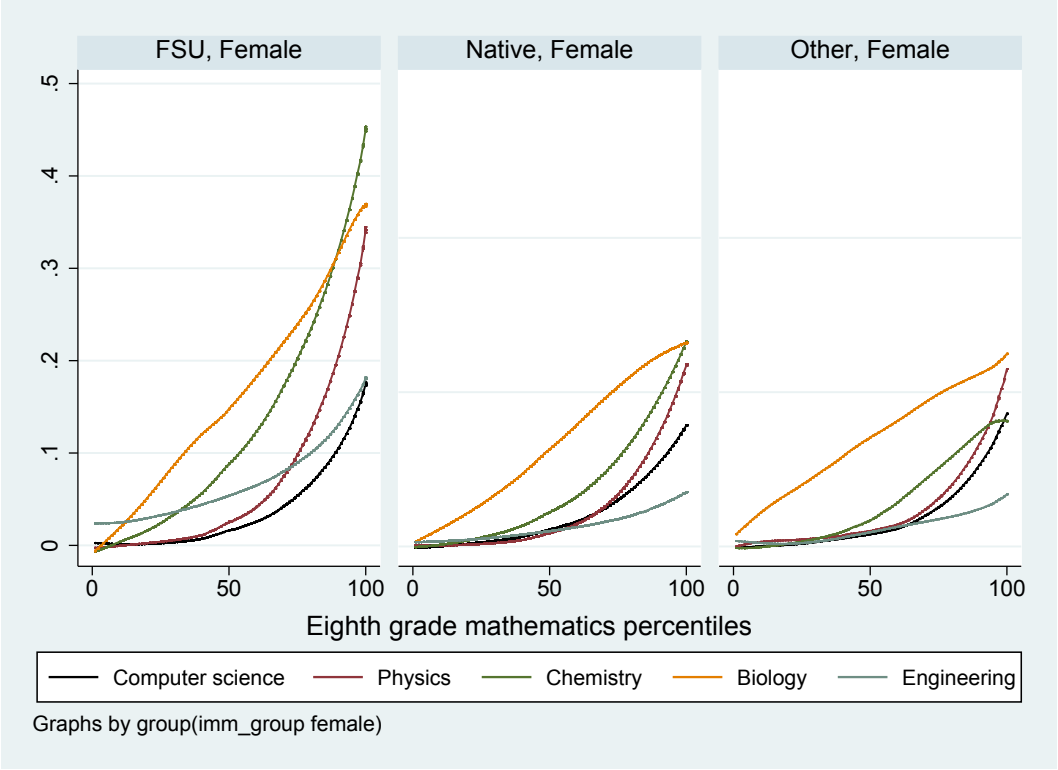
Table 2: Choice of matriculation electives by origin, conditional on SES and prior achievement

	(1)	(2)	(3)
	Full matriculation at the end of HS		
Native	0.047^{***}	0.023^{*}	0.025^{**}
	(0.013)	(0.012)	(0.010)
Other immigrant	0.002	-0.003	0.022
	(0.021)	(0.019)	(0.016)
	Advanced mathematics		
Native	-0.039^{***}	-0.054^{***}	-0.033^{***}
	(0.010)	(0.010)	(0.008)
Other immigrant	-0.064^{***}	-0.081^{***}	-0.041^{***}
	(0.014)	(0.013)	(0.011)
	STEM elective (HS)		
Native	-0.097^{***}	-0.115^{***}	-0.095^{***}
	(0.014)	(0.013)	(0.011)
Other immigrant	-0.106^{***}	-0.118^{***}	$-0.076***$
	(0.020)	(0.018)	(0.016)
	Social science (HS)		
Native	0.050^{***}	0.035^{***}	0.023^{*}
	(0.013)	(0.013)	(0.013)
Other immigrant	-0.015	-0.004	-0.013
	(0.018)	(0.018)	(0.018)
Controls			
SES		yes	yes
GEMS			yes
N	30,795	30,795	30,795

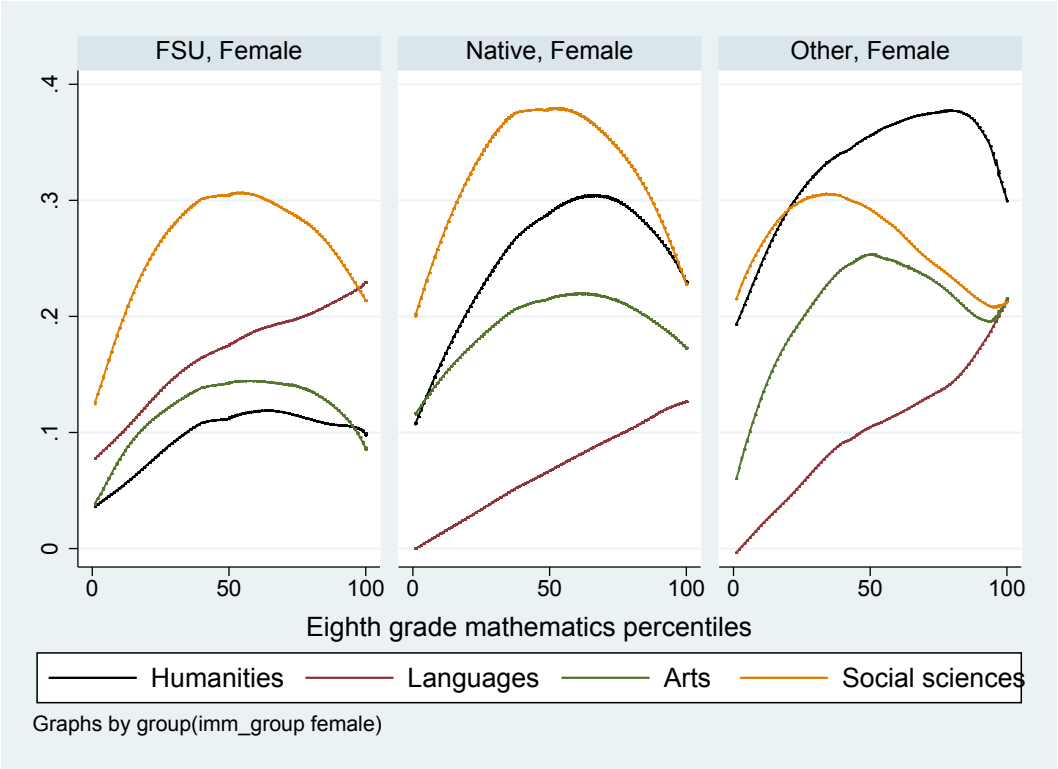
Dependent variables vary by panel. Coefficients in column (1) are obtained from a LPM with school-level clustered standard errors and a dummy for cohort. In column (2) individual SES indicators are added and in column (3) GEMS scores are added. All GEMS scores are normalized to have a mean of 0 and standard deviation of 1, and are included as a second degree orthogonalized polynomial of the four GEMS scores (mathematics, science, reading and English). Clustered standard errors in parentheses. * $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$

Figure 3: Share choosing matriculation electives by eighth grade mathematics deciles and origin

(a) STEM



(b) Non-STEM



In Table 2 we estimate the different propensity to choose selected matriculation fields using Equation 1.The top panel of the table reveals that young women born in the FSU are more likely to choose STEM electives, notwithstanding their eighth grade achievement and socio-economic background. They are also less likely than natives and other immigrants to matriculate and to take matriculation elective in humanities. Conditional on prior achievement and family SES all immigrants are less likely to study social science, and there is no difference between FSU and other immigrants. (Prior achievement, in all domains, play an important role with respect choice, especially the propensity to achieve full matriculation and to choose a STEM elective).

3.2 Tertiary study field choice

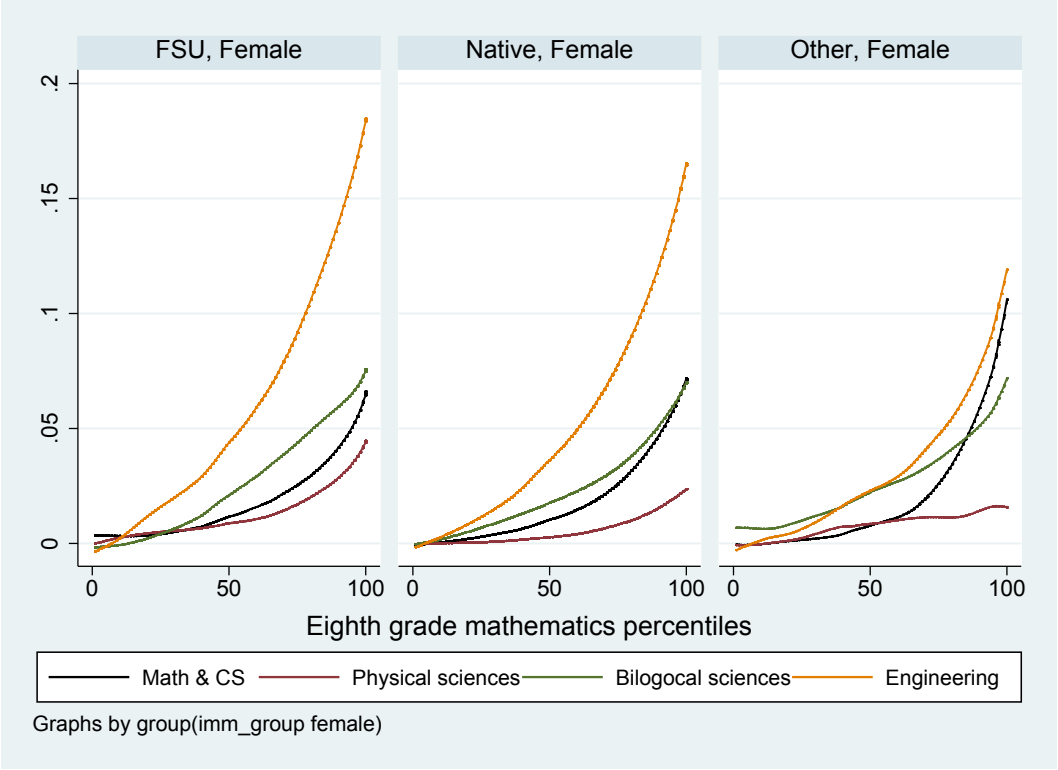
As shown in Table 1, the matriculation rate is lower among all immigrants than among natives, and the gap between matriculation and studying in a tertiary institution is largest among FSU immigrants, which might be due to the lower socio-economic status of immigrants, but also to the higher probability that they seek tertiary education options outside of Israel.

As concerns students' choice of tertiary study field, we expect to see two countervailing forces at work: on the one hand, the influence of the poorer socio-economic background of FSU immigrants is predictive of a low investment in math and STEM, but on the other hand, the influence of the Soviet culture is prone to such investment. Figure 4 shows that FSU immigrants have the highest proportion of STEM students within each math score decile. Given the lower share of FSU immigrants who attend tertiary education, the relative share of STEM students among this group is even higher. Young women born in the FSU disproportionately choose Engineering and architecture and STEM, and refrain from choosing Education and teacher training, as well as Social sciences.

Table 3 displays the estimates of Equation 1 for application to tertiary education and choice of selected study fields.The patterns are similar as those of matriculation electives—even after controlling for prior achievement and family SES, young women born in the FSU are more likely to choose STEM study fields. Conversely, the only non-STEM fields that particularly attracts them

Figure 4: Share choosing tertiary study field by eighth grade mathematics deciles and origin

(a) STEM



(b) Non-STEM

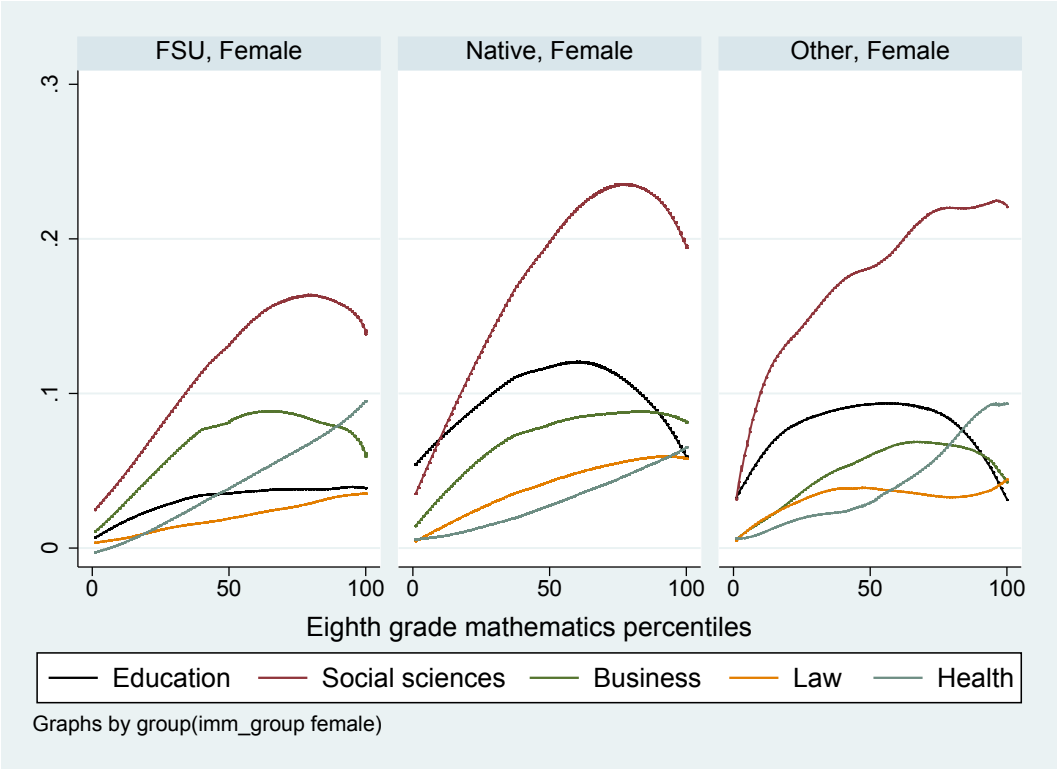


Table 3: Choice of tertiary study fields by origin, conditional on SES and prior achievement

	(1)	(2)	(3)	(4)	(5)
	Applied to tertiary education				
Native	0.077^{***}	0.007	0.030^{***}	0.034^{***}	0.005
	(0.008)	(0.007)	(0.007)	(0.009)	(0.011)
Other immigrant	0.053^{***}	0.019	0.037^{***}	0.031^{*}	-0.003
	(0.016)	(0.013)	(0.012)	(0.017)	(0.024)
	STEM study field (tertiary)				
Native	-0.027^{***}	-0.035^{***}	-0.007	-0.047^{***}	-0.026^{**}
	(0.005)	(0.005)	(0.005)	(0.009)	(0.011)
Other immigrant	-0.049^{***}	-0.045^{***}	-0.016^{*}	-0.074^{***}	-0.032^{*}
	(0.009)	(0.009)	(0.008)	(0.016)	(0.019)
	Pink collar tertiary				
Native	0.058^{***}	0.041^{***}	0.041^{***}	0.066^{***}	0.013
	(0.005)	(0.005)	(0.005)	(0.008)	(0.011)
Other immigrant	0.043^{***}	0.037^{***}	0.037^{***}	0.069^{***}	0.038^{*}
	(0.010)	(0.010)	(0.010)	(0.017)	(0.022)
	Social science (tertiary)				
Native	0.061^{***}	0.032^{***}	0.028^{***}	0.069^{***}	0.040^{***}
	(0.006)	(0.006)	(0.006)	(0.009)	(0.013)
Other immigrant	0.050^{***}	0.033^{***}	0.025^{**}	0.070^{***}	0.010
	(0.012)	(0.012)	(0.012)	(0.019)	(0.025)
	Business (tertiary)				
Native	0.002	-0.011^{**}	-0.011^{**}	-0.016^{**}	-0.007
	(0.004)	(0.005)	(0.005)	(0.007)	(0.009)
Other immigrant	-0.021^{***}	-0.019^{**}	-0.018^{**}	-0.037^{***}	-0.005
	(0.007)	(0.008)	(0.007)	(0.012)	(0.018)
Controls					
SES		yes	yes		yes
Prior achievement		yes	yes		yes
Prior choice			yes		yes
Psychometric scores					yes
N	30,795	30,795	30,795	17,091	17,091

Coefficients are obtained from a LPM with school-level clustered standard errors and a dummy for cohort. All GEMS scores are normalized to have a mean of 0 and standard deviation of 1. All regression include a second degree orthogonalized polynomial of the four GEMS scores (mathematics, science, reading and English). Robust standard errors in parentheses. * $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$

are Business and medical professions (not including medicine). By contrast, they are spectacularly rarely found in Education tracks—their estimated share in this study field is not statistically different than zero. This is not due to the possible complementarity of this specialization with Hebrew language skills, as FSU immigrants differ both from natives and other immigrants in this respect.

3.3 Attachment to work

To complement our analysis, we use the 2010 Labor Force Survey and Income Survey to compare the labor market characteristics of women from the FSU and other women born after 1970 along three dimensions: hours worked, type of occupation and income. These are not the same individuals as the cohorts studied above, as the latter are slightly too young for their labor market outcomes to be informative, but we limit the sample to an age group that was not likely to be in the labor force prior to immigration.

Descriptive statistics from the Labor force survey, presented in Table 4, show that the proportion of women who do not participate in the labor market is much smaller among FSU women (15%) than in the two other groups (natives - 18%, and other immigrants - 26%) as well as the share of those in part-time employment. Conversely, nearly a third of FSU immigrants worked more than 40 hours per week, 40 hours per week is considered a full time job, against around 23% in the two other groups. Household characteristics play an important role in determining participation, but we see in Table 4 that while FSU immigrants work longer hours on average, they are more likely to have a child in the household and more likely not to be sole provider. However, they are less likely to have very young children (under 5) in the household. Finally, FSU immigrants are as likely to have post-secondary education as natives.

In line with our findings in previous sections, FSU immigrants differ from natives in their occupational choices. Figure 5 displays the share of FSU immigrant women, on the vertical axis, and the share of native women, on the horizontal axis, each occupation. The size of the circle represents the weight of each occupation in the female labor force. Clearly, the structure of FSU

Table 4: Labor force and demographic characteristics of women born after 1970, by origin

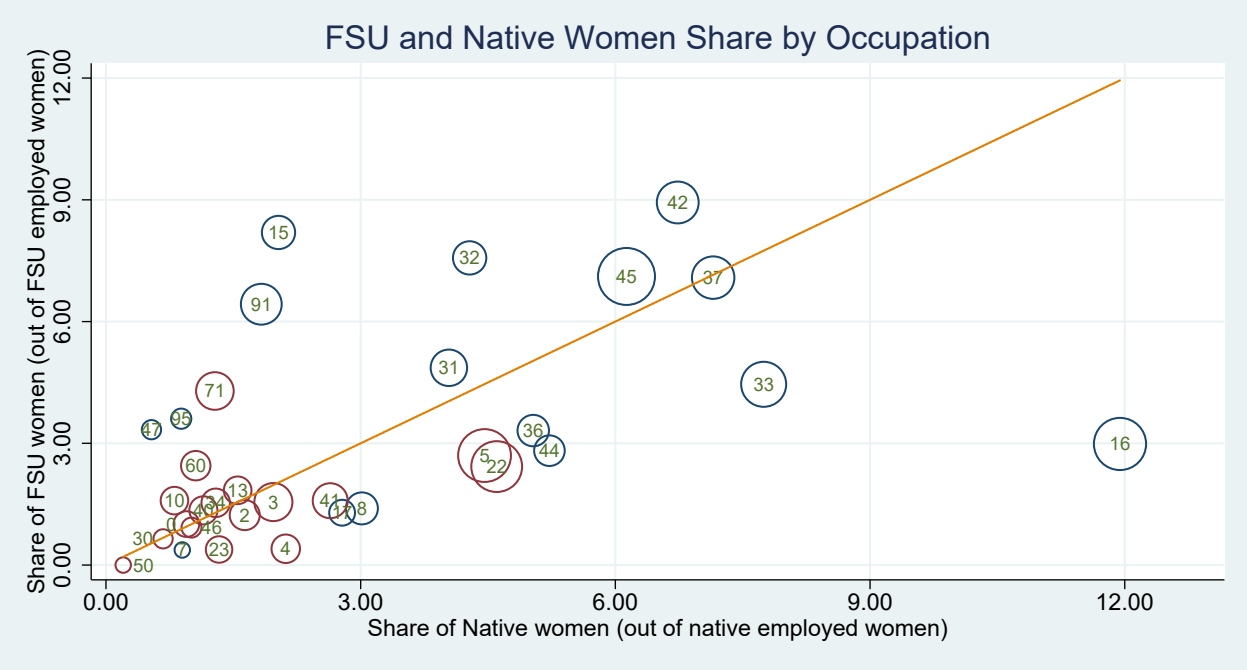
	FSU %	Native %	Other %	Total %
Labor force characteristics				
Does not work	15.25	18.06	26.15	18.46
Works part time	20.92	25.91	26.15	25.09
Works more than 40 hours	30.72	22.75	23.55	24.68
Household characteristics				
At least one child in HH	74.20	70.73	65.51	70.75
At least a child under 5 in HH	42.05	55.29	52.14	52.70
At least one other HH member works	78.20	70.11	58.70	70.25
Education				
Post-secondary education	56.80	57.31	50.29	56.47

Source: Labor Force Survey, 2010, Central Bureau for Statistics. Our calculations. $N = 2,681$, sample includes female respondents born after 1970.

female occupations differs from that of natives, as few occupation categories lie on the 45-degree line. Only about 3% of women born in the FSU after 1970 work in teaching occupations (16), as compared to 12% for Israeli natives. In comparison, FSU female immigrants are over-represented in para-medical professions (15) which includes medical laboratory workers, nurses and other paramedical professions.

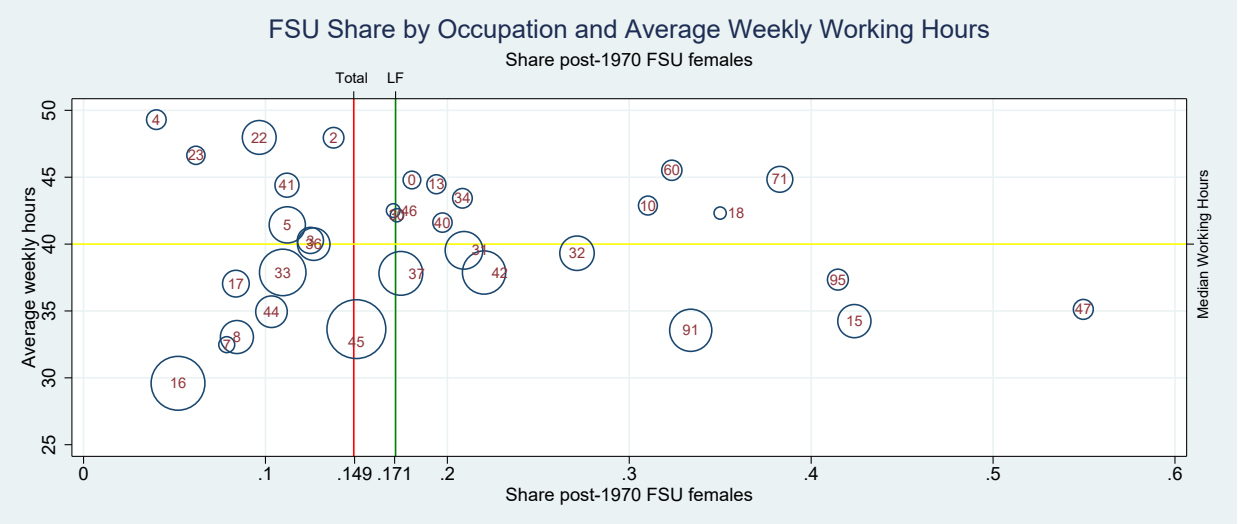
Figure 6 displays the share of FSU female immigrants in each occupation against the average working hours within the occupation, with circles representing the weight of the occupation in the total population. We see that the share of FSU immigrant females in an occupation is positively correlated with the average hours worked in that occupation. Figure 7 displays the difference in hours worked by FSU women, as opposed to native women, within occupation. The gap is predominantly positive- implying that even within occupation FSU immigrants work longer hours than natives. It is as high as 14 or 17 hours per week in some occupations such as (10) Natural Sciences and Engineering Technicians and Associate Professionals or (17) Journalists and Workers in Arts and Sports. Finally, Figure 8 displays the share of FSU female immigrant in skilled occupations (which require post-secondary education), against the average wage within the occupation, with circles representing the weight of the occupation in the total population. We see

Figure 5: Share of Native and FSU immigrants in occupations



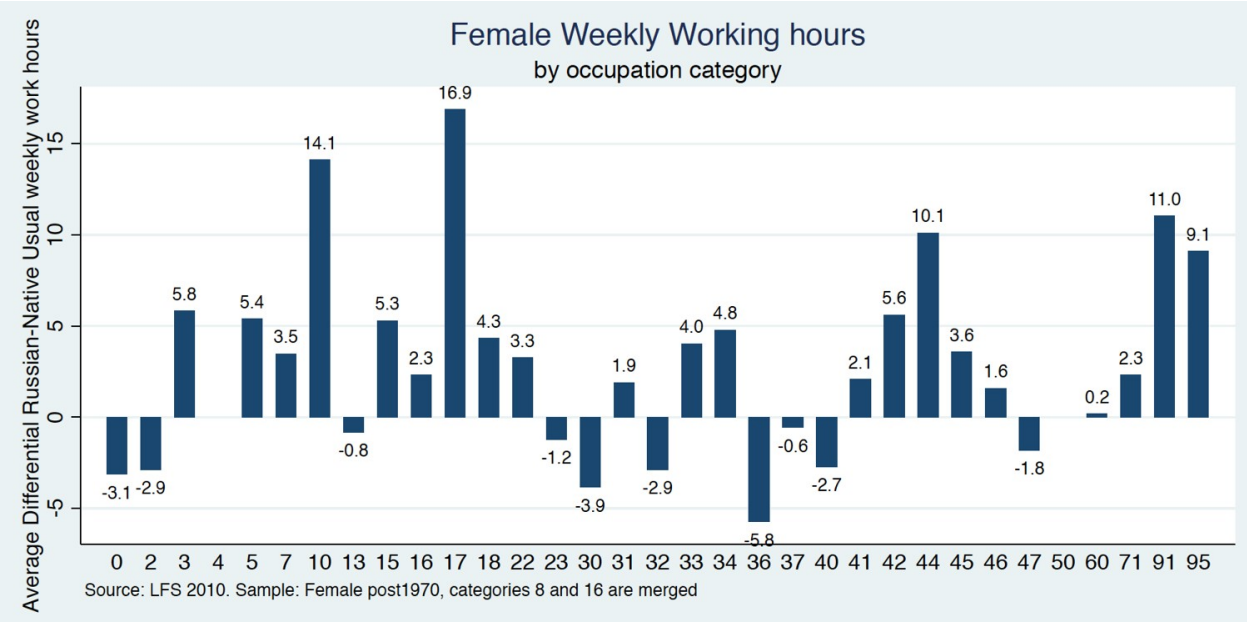
Notes: Authors' calcualtions using 2010 National Labor Force Survey and 2010 National Income Survey of the Central Bureau for Statistic, Israel.

Figure 6: Average weekly working hours by occupation and share of FSU immigrants in occupation



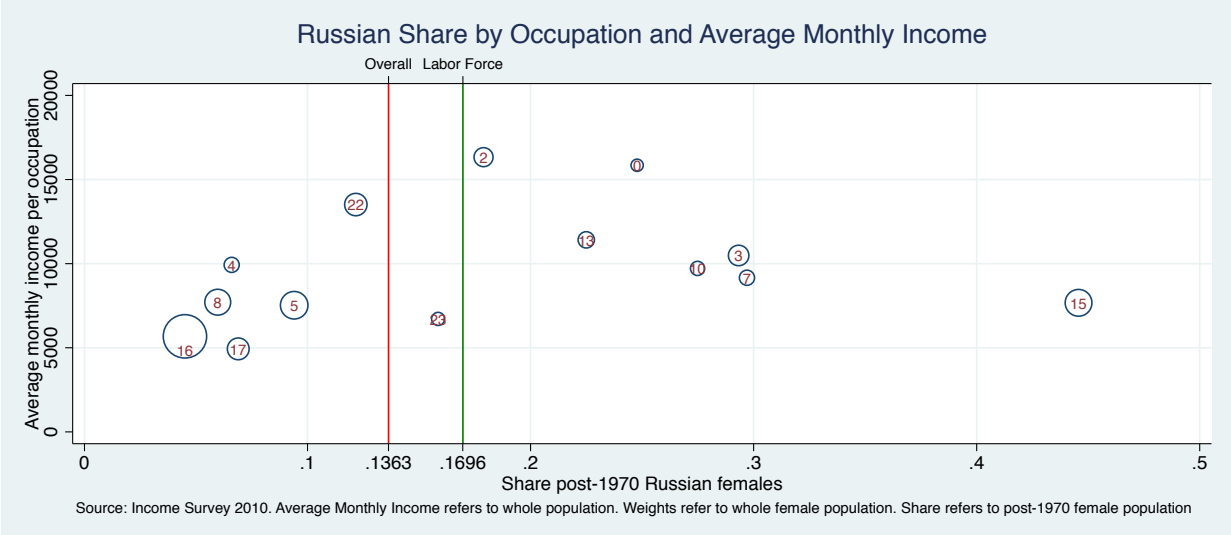
Authors' calculations using national Labor Force Survey 2010. Average Weekly Hours refer to whole population. Weights refer to whole female population. Share refers to post-1970 female population. Authors' calculations using 2010 National Labor Force Survey of the Central Bureau for Statistic, Israel.

Figure 7: Difference in average weekly working hours between natives and FSU immigrants by occupation



Notes: Authors' calcualtions using 2010 National Labor Force Survey and 2010 Income Survey of the Central Bureau for Statistic, Israel.

Figure 8: Income survey



Notes: Authors' calcualtions using 2010 National Labor Force Survey and 2010 National Income Survey of the Central Bureau for Statistic, Israel.

that the share of FSU immigrant females in an occupation is positively correlated with the average income earned in that occupation.

4 Horizontal diffusion of Soviet gender norms

Thus far, we established the persistence of Soviet gender norms among young women who were born in the FSU, but experienced their full education within the Israeli education system. This persistence is due to the vertical inter-generational transmission of preferences within families.[16] We. now turn to the horizontal channel, which operates through local social interactions between groups. We examine whether the concentration of these culturally distinct (FSU) immigrants in middle school, which takes place prior to any school or study field choice, affects the choice behavior of natives, and discuss the possible mechanisms for such an effect.[17]

We construct a variable indicating the share of FSU immigrants among eighth grade pupils within a school.[18] We use the concentration of FSU immigrants in eighth grade, as families do not choose schools but are allocated to them, in primary and middle school, according to catchment areas defined by neighborhood of residence.[19] Therefore we cannot disentangle the effect of the neighborhood from the effect of the school, inasmuch as the concentration of FSU immigrants in a school also proxies the ethnic composition of the neighborhood. We address this point below. Figure 9 shows that approximately 10% of native students attend schools with no FSU immigrants and half of the population attends schools with a share of FSU immigrants ranging between 5% and 23%. This variation creates the opportunity to test for social interactions stemming from exposure in early education to distinct cultural gender norms.

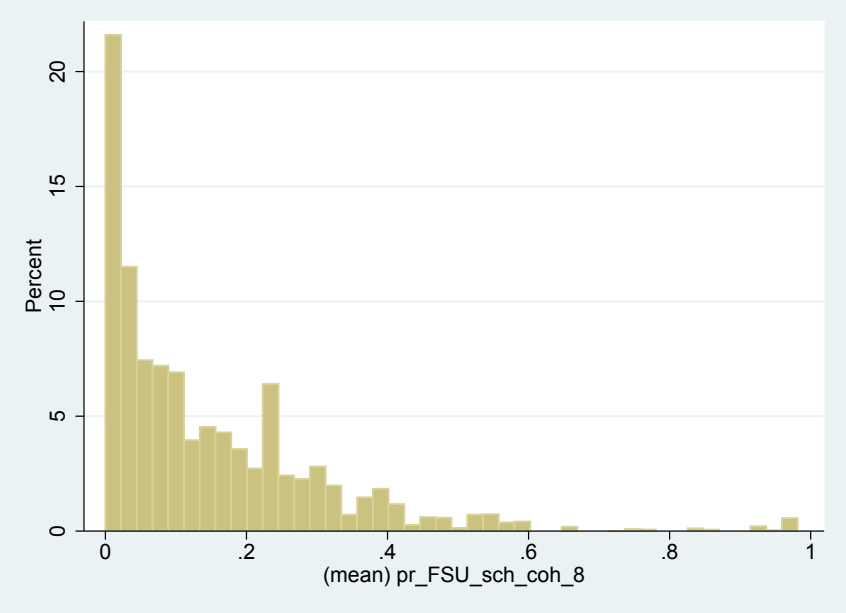
[16]We distinguish investment in specific skills, e.g. mathematical skills, which should be captured by our measures of achievement, from preferences over study fields and occupations, which are culturally conditioned.

[17]This channel may also affect other immigrants. However, given the small sample size and heterogeneity of this group in our context, we cannot reliably analyze this interaction.

[18]Grade (school) level variables are constructed using all students in the grade (school), irrespective of their inclusion in the study sample. For instance, the share of immigrants includes both male and female students, as well as students who have not taken any of the GEMS.

[19]There was no school choice in Israel prior to high school in the years we are considering.

Figure 9: Distribution of share of FSU immigrants in eight grade



Notes: $N = 29,349$. *Grade level characteristics are are calculated only for schools for which we observe at least 10 students at the grade level. Horizontal axis represents the share of FSU immigrant in the grade level of the individual in the year in which they attended eighth grade.*

As discussed by Manski (1993), several endogenous and contextual (exogenous) effects of school composition could be at play. First, in our context, an *endogenous* effect could operate by reducing "stereotype threat" in choosing STEM for native young women, given that FSU young women select into STEM courses at higher rates, increasing the share of young women in such classes. A *contextual* effect may appear if a high concentration of FSU immigrants in a neighborhood or school generates demand for STEM related extra-curricular activities or exerted pressure on local schools to improve the level of STEM teaching, both of which may benefit native students as well.[20]. Alternatively, given the human capital characteristics discussed in section 2, the prevalence of FSU immigrants in a neighborhood may increase the exposure of young women to older women with STEM careers serving as role models. Finally, Manski's model of peer effects includes *correlated* effects, when individuals share common institutional settings or similar

[20]While schools, especially in elementary and middle schools have little control over curriculum, they can affect small shifts at the margins- especially through the choice of supplementary programs, supplied by the non-governmental sector

unobserved background characteristics (the so called reflexion problem). In our context, this could be the case if FSU immigrants concentrated in neighborhoods with a high share of parents working in STEM occupations, or if FSU immigrants choose neighborhoods of residence based on the quality of schools with respect to STEM education.

We estimate an extension of equation 1, adding $\lambda_j FSU8$ as an explanatory variable capturing the share of FSU immigrants in middle school. If as suggested above, FSU immigrants selected into neighborhoods with better school quality or populations with similar educational and occupational characteristics, our estimates of λ_j would be biased upwards. We therefore begin our analysis by examining the composition of schools attended by FSU immigrants.

It is well documented that the prevalence of STEM study fields is positively correlated with the SES of students (Friedman-Sokuler and Justman (2016)) . In Israel, immigrants arriving in the 1990's (predominantly from the FSU) concentrated in municipalities where the native population had lower socio-economic status (Gould *et al.*, 2009).[21] The top panel of Figure 10 shows that the share of FSU immigrants in a school is negatively correlated with the average education and income of native families in the school. The bottom two panels of Figure 10 depict the relationship at the individual level between characteristics of municipality of residence and share of FSU immigrants in eighth grade, using municipality data from the 1995 Population Census.[22] Naturally, the share of FSU students in the eight grade of a school depends on the share of FSU immigrants in the local population as measured both in the 1995 and the 1983 census (prior to the mass immigration wave). The lower panel of Table 4 shows that the share of FSU immigrants in a school is negatively correlated with the municipality employment level and is unrelated to the share of High-Tech employees in the district ((Central Bureau of Statistics, 2017)).[23]

Table 5 estimates the relationship between the share of FSU immigrants in eighth-grade and selected outcomes, conditional on individual characteristics, as described in Equation 1. To

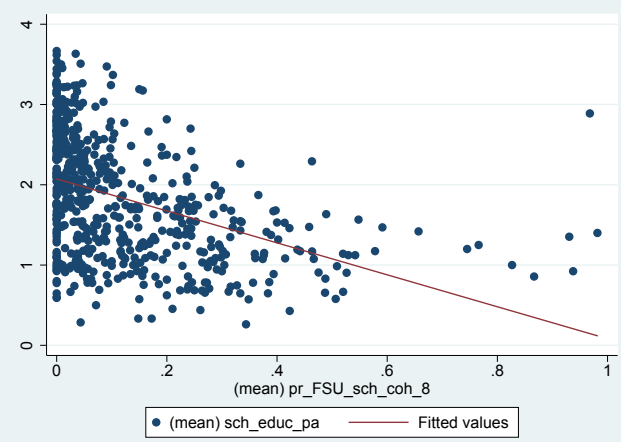
[21]The essential reason for this is lower housing prices, as well as government construction programs meant to meet the high housing demand after the wave of immigration from the FSU.

[22]We use Population Census data because only the census offers detailed data at the municipality level, irrespective of size. The census is supposed to happen once every 10 years, and 1995 census is the latest census to occur before our sample attended eight-grade in 2002-2003. The next census occurred in 2008.

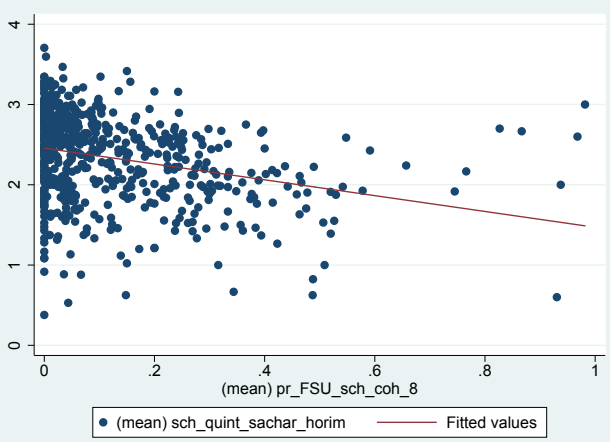
[23]Tabel A2 regresses $FSU8$ on various control variables and reveals the same pattern.

Figure 10: Share of FSU immigrants in eight grade, by selected school and municipality of residence characteristics

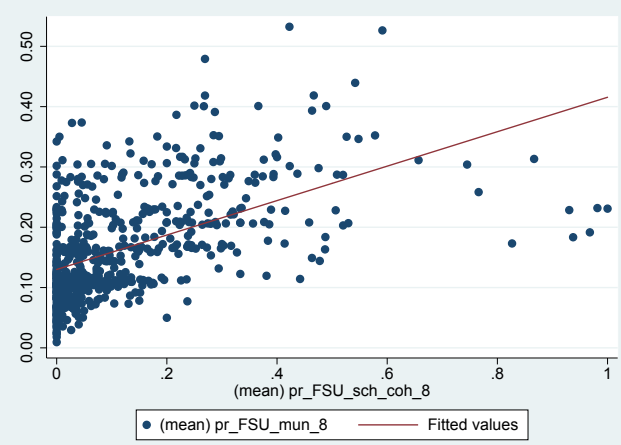
(a) School average parental education



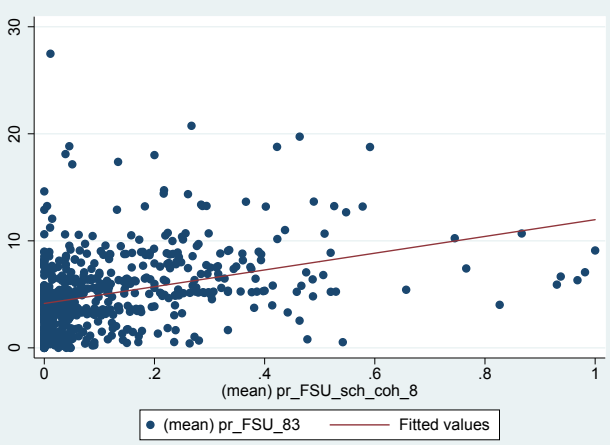
(b) School average family income quintile



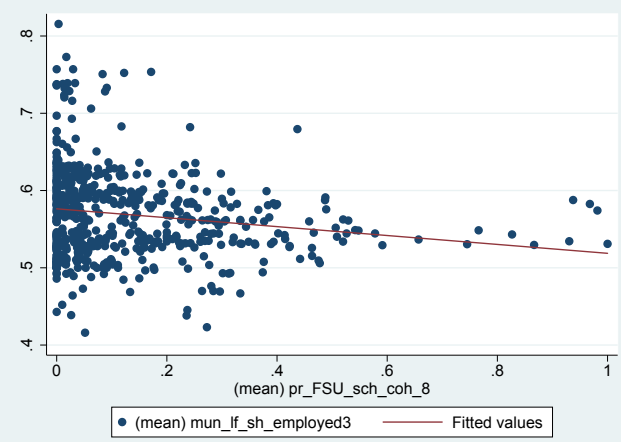
(c) Share FSU immigrants in municipality, 1995



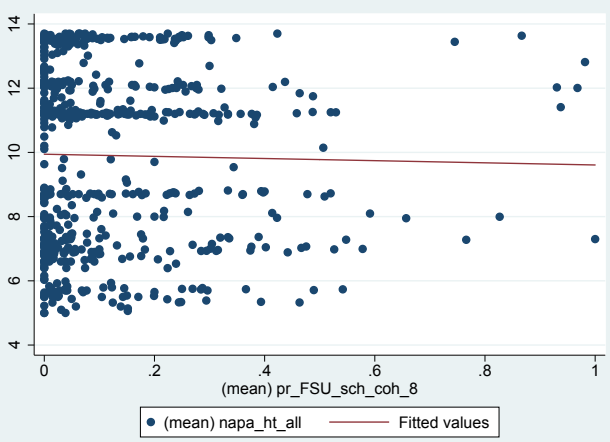
(d) Percent FSU immigrants in municipality, 1983



(e) Share employed in municipality, 1995



(f) Percent in Hi-Tech occupations in district/sub-district



Notes: In the top panel, each dot represents a school, $N = 553$, In the bottom two panels dot represent individual students.

Table 5: Estimates of social effect of FSU immigrant concentration in eighth grade

	(a) GEMS scores*			
	English	Hebrew	Mathematics	Science
Without SES controls				
% FSU 8^{th} $grade$	-0.078***	-0.124***	-0.102***	-0.031
	(0.026)	(0.022)	(0.029)	(0.027)
% FSU 8^{th} $grade^2$	-0.010	0.032**	0.013	0.013
	(0.016)	(0.015)	(0.018)	(0.017)
With SES controls				
% FSU 8^{th} $grade$	0.079***	-0.002	-0.003	0.050*
	(0.023)	(0.023)	(0.032)	(0.030)
% FSU 8^{th} $grade^2$	-0.036***	0.008	0.002	0.003
	(0.012)	(0.013)	(0.017)	(0.015)

	(b) Attainment and choice**			
	Full matriculation	STEM matriculation elective	STEM tertiary	Pink collar (tertiary)
Without SES controls				
% FSU 8^{th} $grade$	-0.325***	-0.120**	-0.046	-0.469***
	(0.053)	(0.055)	(0.047)	(0.056)
% FSU 8^{th} $grade^2$	0.079**	0.015	-0.032	0.166***
	(0.033)	(0.031)	(0.036)	(0.028)
With SES controls				
% FSU 8^{th} $grade$	-0.081	-0.030	0.178***	-0.248***
	(0.053)	(0.063)	(0.050)	(0.053)
% FSU 8^{th} $grade^2$	0.032	0.013	-0.062*	0.087***
	(0.031)	(0.032)	(0.033)	(0.030)

Sample of native students. Coefficients reported are logistic regression estimates. Dependent variables vary by vertical panel. The variable 'Share FSU in 8th grade' is standardized with mean 0 and standard deviation of 1. Individual SES controls include family income quintiles and parents' highest level of education. School level controls include the means of income and education measures at the school level (including three cohorts). Robust standard errors, or clustered at school level in parentheses. * $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$

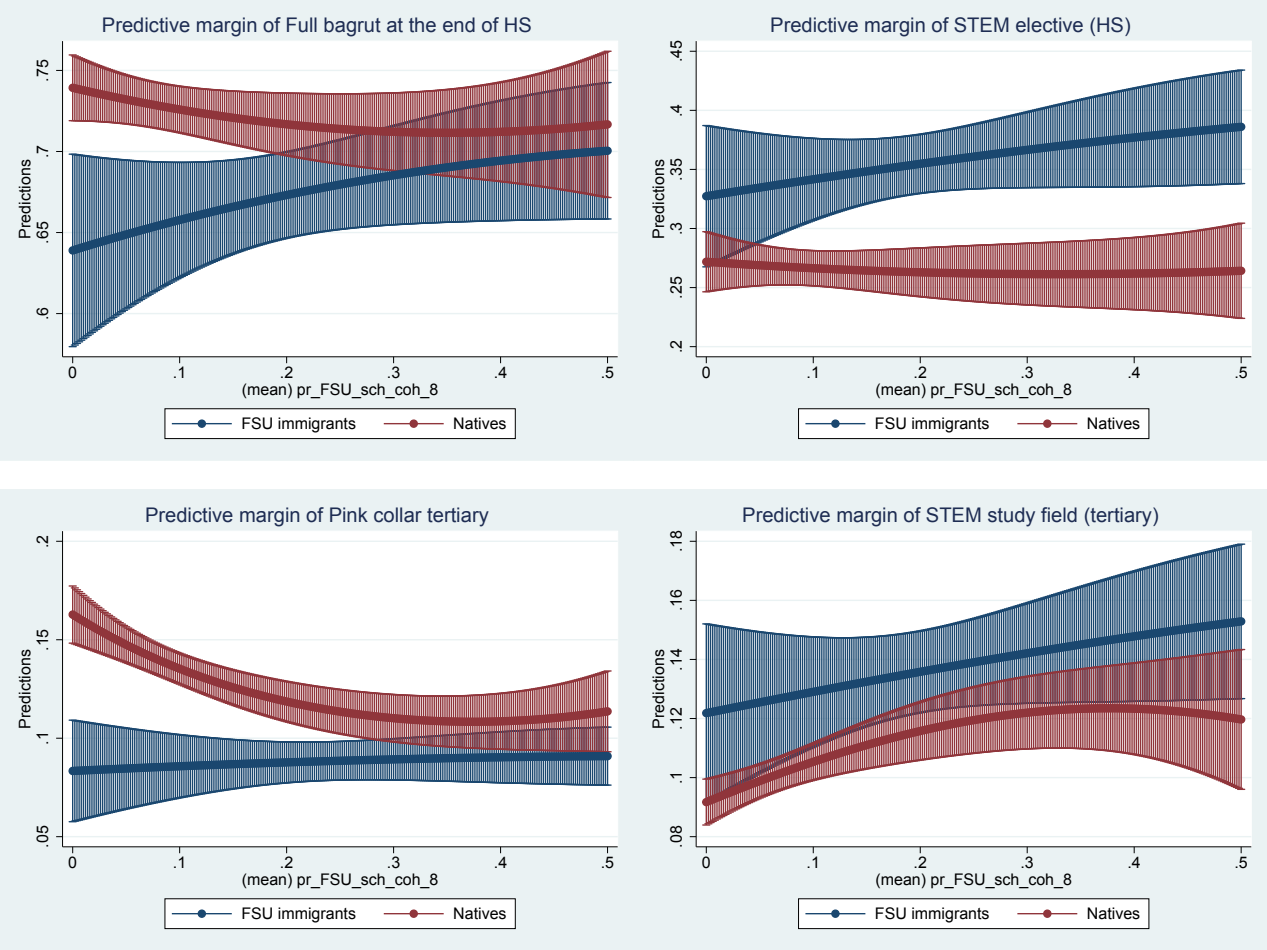
account for the selection of immigrants into lower SES neighborhoods, we show the effect of adding controls for the average level of parental education and family income quintiles of natives in a school. In panel (a) of Table 5 the outcomes of interest are the four eighth grade scores. Without controls, all scores are negatively correlated with share of FSU immigrants in eight grade. However, when controlling for individual characteristics, the coefficients are no longer negative and become positive and statistically significant in English and Science. Adding controls for school

SES reveals that, as expected, selection into poorer neighborhoods indeed biases these estimates downwards.

Panel (b) of Table 5 shows the correlation between the share of FSU immigrants in middle school and the choice of native young women in secondary and tertiary education. Without controls, the likelihood of obtaining full matriculation or choosing STEM is negatively associated with the share of FSU immigrants in eighth grade. But conditional on SES, these correlations shrink and become statistically insignificant. With respect to tertiary education choice, conditional on SES characteristics, native women who were exposed in early education to a large share of FSU students are significantly more likely to enroll into a STEM tertiary program, and much less likely to choose education and teacher training.

Figure 11 shows the predicted probabilities of various choice outcomes for natives as a function of $\%\ FSU\ 8^{th}\ grade$, using the estimates from Table 5. We omit the schools with more than 50% FSU immigrants because standard errors become extremely large, as this situation is relevant to less than 3% of native students in our sample. With respect to choosing STEM in secondary and tertiary education, FSU immigrants are positively affected by the concentration of their peers. Native appear to be slightly negatively affected in secondary school, and we found that this is driven be a decrease in the propensity to choose biology. However, in tertiary education, the probability that native young women choose STEM increases by nearly 50% (4 percentage points) as the proportion of FSU immigrants rises from 0 to 20%, a range which is representative of most of the sample. The opposite pattern appears for Pink Collar tertiary study fields (Education and Healthcare occupations), where FSU immigrants are seemingly unaffected by the share of their own group, but natives dramatically reduce their propensity to choose Pink Collar occupations as their early exposure to FSU schoolmates increases.

Figure 11: Predicted probabilities for native and FSU immigrants as a function of share FSU immigrants in grade eight.



Notes: Predicted probabilities and 95% confidence intervals are calculated from separate logistic regressions for each origin group. All estimates are conditional on individual family income quintile and parents' highest level of schooling, as well as a polynomial of the share of FSU immigrants in eight grade and school level averages of natives' income quintile and parental education.

5 Conclusion

The unexpected massive flow of FSU immigrants to Israel in the early 1990's creates the opportunity to illustrate the vertical persistence and horizontal diffusion of cultural norms, in particular concerning gender identity. Here, we document the durable scientific culture inherited from Soviet times, as well as the special attachment to work of FSU women. The latter do not seem to choose their education tracks and occupations in view of their work-life balance. De facto, once in the labor market, they work for longer hours, more often in full-time jobs, and for higher wages, than native or other immigrant women. They are more attracted to STEM, medical and business occupations, and avoid the appeal of the female-dominated teaching sector. We interpret these features as a legacy of the socialist episode, where full labor market participation was the norm for women (as well as men). As a lot of FSU immigrants have settled in specific areas, based on the presence of their compatriots and on the lower rents, we are able to document the influence of the concentration of FSU students in a school on the educational choices of native young women who attended the same school in eighth grade. We show that the behavior of native young women, at all stages of their education tracks, converges towards the patterns that are typical of FSU ones.

As a final remark, let us recall the decisive role of the "child penalty" in the divergence of men and women's careers. With respect to this, in socialist countries, institutions were designed in order to make full-time female employment compatible with maternity. It turns out that, once in Israel, FSU immigrants have developed a network of private kindergarten (the Association of Immigrant Teachers - IGUM) that welcome children from 2 to 5 years old, from 7 am until 7 pm, and half-day on Fridays, in contrast with standard Israeli public and private kindergarten, which close around 4:30 pm (and on friday). They offer a very large curriculum usually unavailable in public establishments, which includes plastic arts, music, drama and theater, physical education, ballroom dancing, English, Russian, arithmetic, logic, and nature. Almost all the children who attend these kindergartens are born in Israel to parents from the former Soviet Union. Russian is the official language.[24] This is revealing of the general attitudes of FSU women concerning the

[24] Haaretz, December 27, 2018.

respective place of paid-work and motherhood in their time and investment. In a way, FSU women have managed to reproduce some (private) institutions that allow them to reach the same level of work-family balance as they had in Soviet times. This is a powerful illustration of the persistence of culture, but also of the reciprocal influence of culture on institutions.

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A1 Immigrant shares in study cohorts

Table A1: Immigrants by country of origin, full population (including male students)

	N	% of immigrants	% of population
FSU immigrants			
Former Soviet Union Countries	9,219	73.10	14.15
Former European Communist countries	120	0.95	0.18
Other immigrants			
Ethiopia	1,140	9.04	1.75
United States and Canada	912	7.23	1.40
France	217	1.72	0.33
Argentina	192	1.52	0.29
Other European countries	145	1.15	0.22
Other Latin America Countries	143	1.13	0.22
MENA countries	141	1.12	0.22
Brazil	111	0.88	0.17
United Kindom	107	0.85	0.16
Other Africa	86	0.68	0.13
East Asia	28	0.22	0.04
Australia	26	0.21	0.04
Scandinavian countries	25	0.20	0.04
Total immigrants	12,612		0.19
Native Israeli	52,561		0.81
Total	65,173		

Countries with less than 20 immigrants are reported as part of broader categories due to data restrictions on individual level data.

A2 Correlates of the share of FSU immigrants in eighth grade

Table A2: Share of FSU immigrant in grade level conditional on individual characteristics of natives and municipality characteristics

	(1)	(2)	(3)
Dependent variable:	Share of FSU immigrants in eighth grade		
Parents' maximal level of education, omitted category: 13-15 years			
Less than 12 years	0.015***	0.015***	0.011***
	(0.003)	(0.003)	(0.003)
12 years	0.015***	0.015***	0.013***
	(0.002)	(0.002)	(0.002)
More than 16 years	-0.014***	-0.013***	-0.012***
	(0.002)	(0.002)	(0.002)
Family income quintile, omitted category: 3th quintile			
1st	0.005*	0.004*	0.005
	(0.003)	(0.003)	(0.003)
2nd	0.000	0.000	-0.001
	(0.002)	(0.002)	(0.002)
4th	0.001	0.002	0.003
	(0.002)	(0.002)	(0.002)
5th	-0.003	-0.002	0.001
	(0.002)	(0.002)	(0.002)
Municipality characteristics			
Share FSU immigrant in municipality	0.689***	0.672***	0.707***
	(0.009)	(0.009)	(0.012)
Municipality population 1995		-0.000**	-0.000**
		(0.000)	(0.000)
Municipality dependent ratio 1995		-0.000***	-0.000***
		(0.000)	(0.000)
Share of Hi-Tech employees		-0.002***	
in district/region		(0.000)	
Municipality employment level			-0.113***
			(0.015)
Average year of schooling in municipality			0.000
			(0.002)
Constant	-0.001	0.049***	0.099***
	(0.002)	(0.004)	(0.012)
Observations	24,686	24,636	21,281
R-squared	0.341	0.346	0.344

Clustered standard errors in parentheses. * $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$