Economics Bulletin

Volume 38, Issue 3

What is the optimal housing choice for a minimal BMI?

Yuval Arbel
Netanya Academic College

Chaim Fialkoff
Hebrew University of Jerusalem

Amichai Kerner
Netanya Academic College

Abstract

Housing choice is based on several criteria, one of which is the projected health of its residents. Because health-related characteristics vary by gender, these differences may give rise to a conflict of interest between a heterosexual couple when choosing a suitable home, in a similar manner to the battle of sexes game, including the relationship between the type and size of the dwelling unit and obesity. The optimal choice should test the minimal aggregated BMI. Yet, this might leave one of the two sides in a less than optimal situation. We simulate these effects based on real-life data obtained from an Israeli Central Bureau of Statistics two-year longitudinal survey.

The authors are grateful to Israel Social Sciences Data Center (ISDC), the Hebrew University of Jerusalem for provision of project data and to Yifat Arbel, Miri Kerner and Odelia Rosin for helpful comments.

Citation: Yuval Arbel and Chaim Fialkoff and Amichai Kerner, (2018) "What is the optimal housing choice for a minimal BMI?", *Economics Bulletin*, Volume 38, Issue 3, pages 1313-1337

Contact: Yuval Arbel - yuval.arbel@gmail.com, Chaim Fialkoff - cfialk@gmail.com, Amichai Kerner - kerneram@netvision.net.il.

Submitted: March 04, 2018. **Published:** July 18, 2018.

Economics Bulletin

Submission Number: EB-18-00195

WHAT IS THE OPTIMAL HOUSING CHOICE FOR A MINIMAL BMI?

Yuval Arbel
Netanya Academic College

Chaim Fialkoff
Hebrew University of Jerusalem

Amichai Kerner
Netanya Academic College

Abstract

Housing choice is based on several criteria, one of which is the projected health of its residents. Because health-related characteristics vary by gender, these differences may give rise to a conflict of interest between a heterosexual couple when choosing a suitable home, in a similar manner to the battle of sexes game, including the relationship between the type and size of the dwelling unit and obesity. The optimal choice should test the minimal aggregated BMI. Yet, this might leave one of the two sides in a less than optimal situation. We simulate these effects based on real-life data obtained from an Israeli Central Bureau of Statistics two-year longitudinal survey.

The authors are grateful to Israel Social Sciences Data Center (ISDC), the Hebrew University of Jerusalem for provision of project data and to Yifat Arbel and Miri Kerner for helpful comments.
Submitted: March 04, 2018.

1. INTRODUCTION

One of the long-range desirable criteria for a housing choice is the projected health of the residents of the dwelling unit. Given that obesity and lack of physical activity are known risk factors for numerous health problems, including hypertension, high cholesterol, diabetes, cardiovascular diseases and some forms of cancer (e.g., OECD report, 2016, page 98), body fat is an important measure for health in industrialized societies. Body fat is also related directly to housing choice opportunities to increase physical activities (e.g., Creatore *et. al.*, 2016; Sallis *et. al.*, 2016; Arbel *et. al.*, 2018).

A known measure of obesity is called "Body Mass Index" (BMI), which is calculated as $\frac{WEIGHT}{HEIGHT^2}$ where WEIGHT is measured in kilograms and HEIGHT is measured in meters. A widely adopted definition of overweight is a body mass index (BMI) greater than or equal to 25, with obesity defined as BMI $\geq$30 (Qin and Pan, 2016; page 1293; OECD, 2016; page 98).

Based on the regression outcomes obtained from real-life data in Arbel *et. al.* (2018), the objective of the current study is to simulate these results and analyze them from a normative perspective. In particular, we extend Arbel *et. al.* (2018) and propose a decision rule for housing choice based on a minimal aggregated BMI criterion, and apply this rule to heterosexual couples with and without children. We then analyze whether, like the battle of sexes game, a gender-related conflict of interest arises, which leaves one of the two sides in a less desirable health-related position. Finally, we compare between the desirable and actual housing choice in the context of number of rooms and single- versus multi-family units.

Results indicate that indeed for heterosexual couples without children, a gender-related conflict of interest arises with the application of the aggregated decision rule. Considering the fact that the null hypothesis of overweight (proj(BMI)$\geq$25) is rejected for both genders, the best choice in terms of aggregated projected BMI will be a one-room apartment.[1] Yet, if the heterosexual couple is separated, the best choice from a women's (men's) perspective is at odds with the shared decision - the five-room apartment (consistent with the couple's decision of one-room apartment). Referring to the type of apartment, according to the aggregated rule, the optimal choice for a heterosexual couple would be a single family home, whereas prior to the marriage, the best choice for the single men (women) would be at odds with the couple's decision, namely, the multi-family apartment (consistent with the couple decision of single-family unit).

Interestingly, under equal conditions, conflict-of-interest disappears in a household with children, and the optimal choice would be a five-room apartment. For both genders, projected BMI increases with the number of children. Yet, the difference in aggregated projected BMI becomes smaller with an additional number of rooms. A potential explanation is that the resulting expenditures on children leaves parents with fewer resources to spend on themselves including leisure-time physical activity (e.g., Blackorby and Donaldson, 1994). However, the marginal impact of the second child is larger than that of the third child for parents residing in a one-room apartment.

The remainder of this article is organized as follows. Section 2 discusses the gender-related issues. Section 3 reports the simulation results. Finally, Section 4 concludes and summarizes.

[1] Rooms include living rooms and bedrooms but not kitchen or bathrooms.

2. THE BATTLE OF SEXES IN GAME THEORY

This classical game has been described in game-theory textbooks (e.g., Luce and Raffia, 1957, page 90-91; Osborne and Rubinstein, 1994; page 35) as-well-as research papers (Lau and Mui, 2008, page 154). Here we give the description provided by Lau and Mui (2008).

Table 1 describes a game between two players of different genders, who have to decide whether to go to a football game or a ballet performance. While the row player (the husband) prefers to go to the football game, the column player (the wife) desires to go to the ballet performance.[2] Both players receive pleasure from cooperation, namely, going together to activity of leisure, otherwise they get zero pleasure even if they go to their preferred recreation. Consequently, the two Nash equilibria of the game are obtained if the couple goes together either to the football game or the ballet performance.

Table 1: The Battle of Sexes

Row Player: Men		Column Player: Women	
		Football	Ballet
	Football	*(H, L)*	(0,0)
	Ballet	(0,0)	*(L, H)*

Notes: *H* is high positive value; *L* is low positive value, where $0<L<H$.

Another aspect of the game is a conflict of interest, which emanates from the fact that comparing the pleasures of both sides separately, one of the two sides receives less pleasure from the other (i.e., $0<L<H$ in Table 1). In that context, Luce and Raffia, 1957 stress the possibility of one side to insist on his or her preferred recreation. This leaves the other side with no choice but to join the less preferred recreation.

As demonstrated in subsequent sections, we use the gender-related game theory construct to describe the mutual choice of the optimal decision and conflict of interests associated with this mutual decision if such a conflict arises. Yet, a unique feature of our study is the use of a cardinal instead of an ordinal measure, namely the calculated projected BMI, which, in turn, may affect health.

3. SIMULATION AND ANALYSIS

3.1 Married Jewish Israeli Couples without Children

To generate the simulation based on real-life data, namely, the Israeli CBS longitudinal survey for 2015-2016, we run two versions of the following empirical model separately for women and men:

(1)

$$\ln(BMI) = \alpha_0 + \alpha_1 PENTHOUSE\_DUPLEX + \alpha_2 GARDEN + \alpha_3 SINGLE\_FAMILY + \alpha_4 BALCONY + \alpha_5 ROOMS + \alpha_6 ROOMS\_SQ + \alpha_7 AGE +$$

[2] In Osborne and Rubinstein (1994), while the row player prefers a Bach-work concert, the column player prefers a Stravinsky-work concert.

$\alpha_8 MARRIED + \alpha_9 ARAB + \alpha_{10} OTHER + \alpha_{11} IMM\_EUROPE\_AMERICA +$
$\alpha_{12} IMM\_ASIA\_AFRICA + \alpha_{13} DOMSHELP + \alpha_{14} HHSIZE + \alpha_{15} BELOW\_17 + u_1$

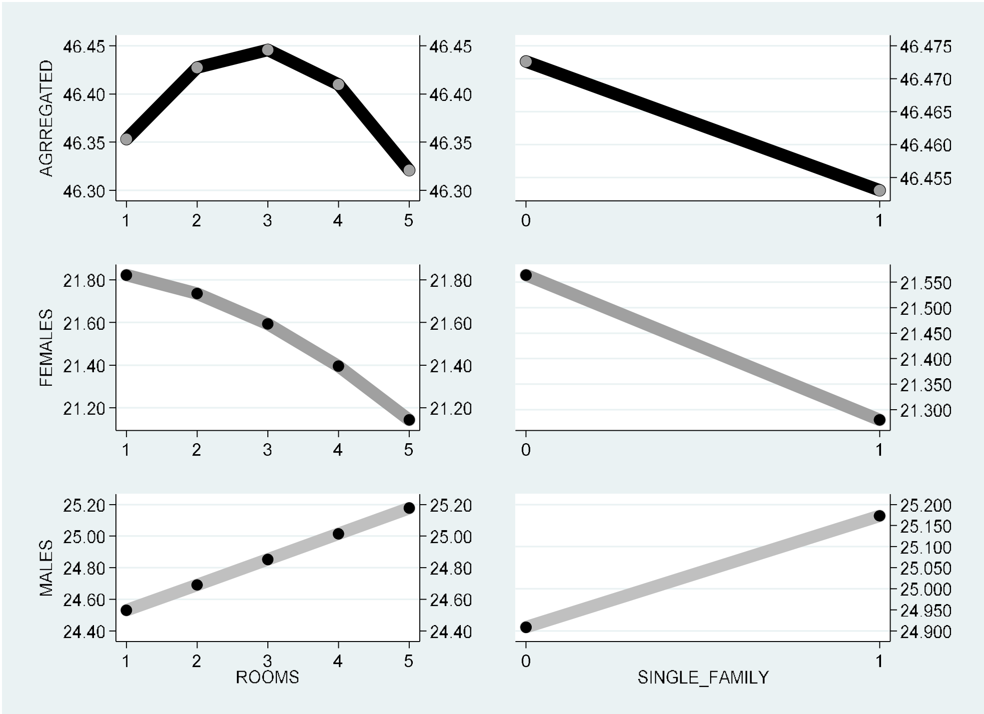
Where $\ln(BMI)$ is the natural logarithm of the *BMI*; $PENTHOUSE\_DUPLEX$, $GARDEN$, $SINGLE\_FAMILY$ equals 1 for penthouse or garden apartment in a multi-family or a single-family detached unit and 0 otherwise (the base category is a conventional housing unit in a multi-family structure); $BALCONY$ equals 1 for apartment with balcony and 0 otherwise; $ROOMS$ is the number of rooms including living room and bedrooms and excluding kitchens or bathrooms; $ROOMS\_SQ$ equals $ROOMS$ raised to the second exponent; AGE is the age in years ($20 \leq AGE \leq 62$ for females, and $20 \leq AGE \leq 67$ for males, where the upper bound is the workforce retirement age); $MARRIED$ equals 1 for married individual, and 0 otherwise; $ARAB$ and $OTHER$ equals 1 for Arab and other non-Jewish individuals and 0 otherwise (the base category is *JEWISH*); $IMM\_EUROPE\_AMERICA$, IMM_ASIA_AFRICA equals 1 for immigrants from European-American and Asian-African countries, respectively, and 0 otherwise (the base category is Native Israelis); $DOMSHELP$ equals 1 if the individual obtains professional domestic cleaning services and 0 otherwise; *HHSIZE* equals the number of persons in the household; $BELOW\_17$ is the ratio between the number of household members below 17 years and the total number of household members in percentage points (for households with no children below 17 years, $BELOW\_17$=0) ; $\alpha_0, \alpha_1, \cdots, \alpha_{15}$ are parameters; and u_1 is the stochastic random disturbance term.

We run two versions of the model given by equation (1): a model that includes and excludes the explanatory variables $ROOMS$ and $ROOMS\_SQ$. Results in Appendix A1 and B1 show that when these two explanatory variables are removed, the coefficient of *SINGLE_FAMILY* becomes statistically significant for both genders. Indeed, the Pearson correlations between these two variables are 30.0% for women, and 28.87% for men. For both genders, the Pearson correlations are significantly different from zero correlation at the 1% significance level.

Figure 1 displays the variation of projected *BMI* with number of rooms and structure type. The upper figure shows variation of the aggregated projected *BMI* of 20-year-old heterosexual couples without children. The middle (lower) graph shows separately the variation of projected *BMI* of the women (men).[3] In Appendix A2-A3 (B2-B3), we explain the algorithms for generating *proj*(BMI) separately for women and men, from which Figure 1 is generated. It should be noted in this context that according to econometric textbooks (e.g., Greene, 2012: 121-122), the formula to produce proj(BMI) from $\text{proj}(\ln(BMI))$ is $\exp(\text{proj}(\ln(BMI))) \cdot \exp(\frac{1}{2}\hat{\sigma}^2)$ where $\hat{\sigma} = \sqrt{MSE}$ of each regression.

[3] As a robustness test we also checked the projections obtained for the 40-year-old cohorts. While compared to the 20-year cohort, all the graphs move upward due to the significant raise in projected BMI with age, the trends shown in Figure 1 for the 20-year-old cohort remain the same.

Figure 1: Variation of Females and Males Projected BMI with the Structure Type and Number of Rooms



		Women	
		One-Room	Five-Rooms
Men	One-Room	(24.53, 21.82)	(24.53, 21.14)
	Five-Rooms	(25.18, 21.82)	(25.18, 21.14)

		Women	
		Condos	Single-
Men	Condos	(24.91, 21.56)	(24.91, 21.28)
	Single-Family	(25.17, 21.56)	(25.17, 21.28)

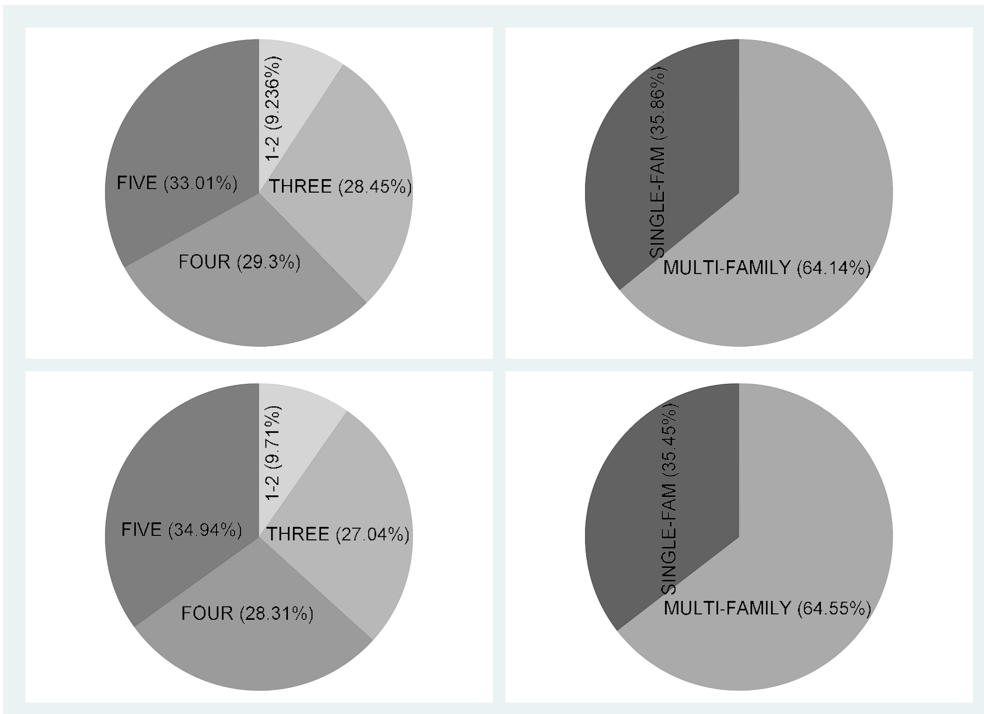
Notes: The figure demonstrates the battle of sexes for 20-year-old married couples without children. The left figure simulates the effect of increase in the number of rooms on the projected level of BMI of 20-year-old married females and males. Projections on the left (right) figure were obtained from columns (2) and (4) in Appendix A1 (B1). Each projected value was converted from proj(ln(BMI)) to proj(BMI) by exponential transformation (see Appendix A2-A3 and B2-B3). The upper figure describes the aggregated projected BMI of both gender with the number of rooms. The middle (lower) figure describes projected BMI of 20-year-old females (males) with the number of rooms.

Referring to the number of rooms, the maximal aggregated projected BMI is obtained for a three-room apartment. Two candidates for optimal choices, which yield the lowest aggregated projected BMI of 46.42 and 46.41, respectively, are the one-room and five-rooms apartments. A further statistical test reveals that for the one-room (five-room) apartment, the 95% (95%) confidence interval for men is $24.12 \leq proj(BMI) \leq 24.95$; ($24.89 \leq proj(BMI) \leq 25.47$) and the 99% (99%) confidence interval for women are: $21.33 \leq proj(BMI) \leq 22.33$; ($20.68 \leq proj(BMI) \leq 21.61$). Given the criteria of proj(BMI)≥25 for overweight, these outcomes indicate that the one-room apartment should be preferred on the five-room apartment.[4]

[4] Referring to the 40-year cohort, the null hypothesis of overweight (proj(BMI)≥25) is still rejected for 40-year old female living at a one-room apartment (99% confidence interval of $23.79 \leq proj(BMI) \leq 24.77$).

Figure 2 describes two pie charts of the number of rooms and structure type for heterosexual couples at work age cohort of 20-62 (20-67) without children below 17 years. Assuming that projected BMI is the dominant criteria for housing choice, our findings suggest a mismatch between the optimal choice of one-room, and the actual choice. 63.945% of the heterosexual couples without children chose to live in 2-4 room apartment. Moreover, 34.94% of the men without children chose the five-room apartment. For this choice, the hypothesis of overweight (proj(BMI)≥25) cannot be rejected even for 20-year old males.

Figure 2: Pie-Chart of the Number of Rooms and Structure Type for Heterosexual Couples without Children



Notes: The left-upper (left-lower) chart refers to 942 (1,102) observations× years who are defined as heterosexual women (men) at work age cohort of 20-62 (20-67) without children belonging to 550 (643) households. The labels 1-2, THREE, FOUR, FIVE refer to the number of rooms. Rooms include living rooms and bedrooms but not kitchen or bathrooms.
The right-upper (right-lower) chart refers to 962 (1,120) observations× years who are defined as married women (men) at work age cohort of 20-62 (20-67) without children belonging to 555 (647) households. The labels MULTI-FAMILY, SINGLE-FAM refer to the structure type. Relative frequencies for each category are given in parentheses.

Similar to the battle of sexes in game theory, the decision rule of aggregated BMI reveals a conflict of interest between the women and men. While the decision rule leading to the choice of one-room apartment is in line with the men's interest, it is against the women's interest. With the shift from one- to five-room apartment, the projected BMI of women (men) is expected to drop significantly (rise significantly) by 3.16% (2.61%). The corresponding 99% confidence intervals are: $-5.57\% \leq$

$ln\frac{[proj(BMI)]for\ FIVE-ROOMS}{[proj(BMI)]for\ ONE-ROOM} \leq -0.75\%$ for females and $0.36\% \leq ln\frac{[proj(BMI)]for\ FIVE-ROOMS}{[proj(BMI)]for\ ONE-ROOM} \leq 4.85\%$ for males.[5]

Referring to the structure type, the minimal aggregated projected BMI is obtained for a single-family unit. Once again, a conflict of interest arises. The female (male) interest is in-line (at odds) with the decision to live in a single family home. A shift from a single family to multi-family unit is expected to drop significantly (rise significantly) the projected BMI of females (males) by 1.32% (1.06%).[6] Finally, note that 64.36% of the persons live in multi-family units. Once again, this indicates a mismatch between the desired and actual structure type.

3.2 Married Jewish Israeli Couples with Children

To consider the impact of the number of children and rooms, we extend the model given by equation (1), so that $\alpha_i = \beta_i$ for $i = 0,1,2,3,4,5,6$; and $\alpha_i = \beta_{2i-7} + \beta_{2i-6}ROOMS$ for $i = 7,8,9,10,11,12,13,14,15$. Substitution yields the following equation with 24 explanatory variables:

(2)

$$\ln(BMI) = \beta_0 + \beta_1 PENTHOUSE\_DUPLEX + \beta_2 GARDEN + \beta_3\, SINGLE\_FAMILY + \beta_4\, BALCONY + \beta_5\, ROOMS + \beta_6\, ROOMS\_SQ + \beta_7\, AGE + \beta_8\, AGE \times ROOMS + \beta_9\, MARRIED + \beta_{10}\, MARRIED \times ROOMS + \beta_{11}\, ARAB + \beta_{12}\, ARAB \times ROOMS + \beta_{13}\, OTHER + \beta_{14}\, OTHER \times ROOMS + \beta_{15}\, IMM\_EUROPE\_AMERICA + \beta_{16}\, IMM\_EUROPE\_AMERICA \times ROOMS + \beta_{17}\, IMM\_ASIA\_AFRICA + \beta_{18}\, IMM\_ASIA\_AFRICA \times ROOMS + \beta_{19}\, DOMSHELP + \beta_{20}\, DOMSHELP \times ROOMS + \beta_{21} HHSIZE + \beta_{22}\, HHSIZE \times ROOMS + \beta_{23}\, BELOW\_17 + \beta_{24}\, BELOW\_17 \times ROOMS + u_2$$

To estimate the effect of the number of children and single-family units, we apply the restriction coef(ROOMS)=coef(ROOMS_SQ)=0 and extend the model given by equation (1), so that $\alpha_i = \delta_i$ for $i = 0,1,2,3,4$; and $\alpha_i = \delta_{2i-5} + \delta_{2i-4}SINGLE\_FAMILY$ for $i = 5,6,7,8,9,10,11,12,13$. Substitution yields the following equation with 22 explanatory variables:

(3)

$$\ln(BMI) = \delta_0 + \delta_1 PENTHOUSE\_DUPLEX + \delta_2 GARDEN + \delta_3\, BALCONY + \delta_4\, SINGLE\_FAMILY + \delta_5\, AGE + \delta_6\, AGE \times SINGLE\_FAMILY + \delta_7\, MARRIED + \delta_8\, MARRIED \times SINGLE\_FAMILY + \delta_9\, ARAB + \delta_{10}\, ARAB \times SINGLE\_FAMILY + \delta_{11}\, OTHER + \delta_{12} OTHER \times SINGLE\_FAMILY + \delta_{13}\, IMM\_EUROPE\_AMERICA + \delta_{14}\, IMM\_EUROPE\_AMERICA \times SINGLE\_FAMILY + \delta_{15}\, IMM\_ASIA\_AFRICA + \delta_{16} IMM\_ASIA\_AFRICA \times SINGLE\_FAMILY + \delta_{17}\, DOMSHELP +$$

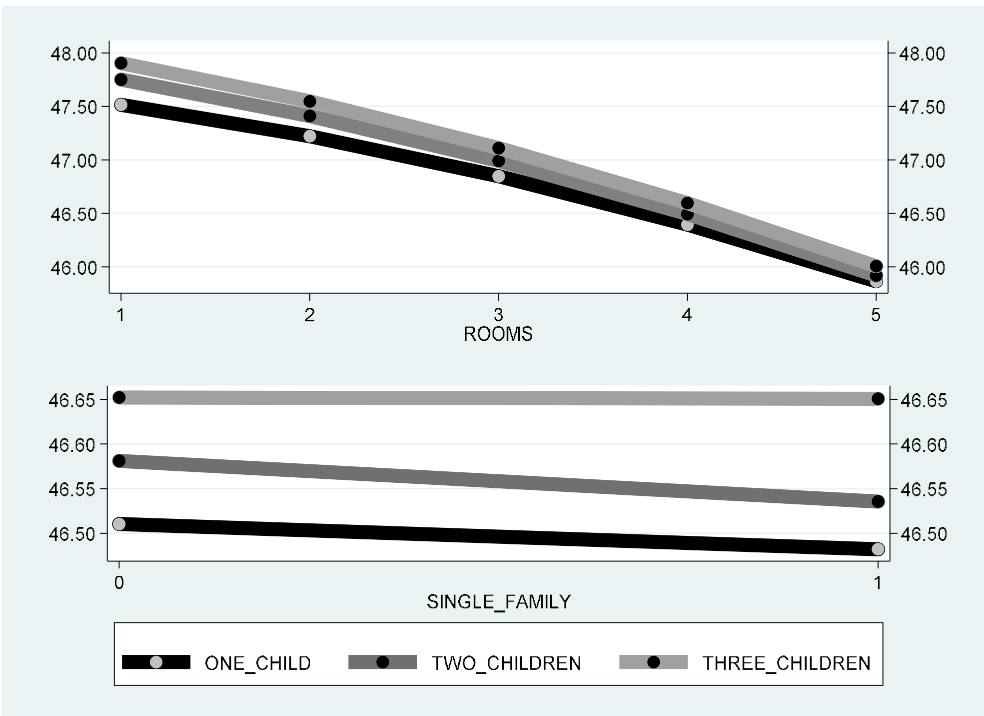
[5] $ln\frac{[proj(BMI)]for\ FIVE-ROOMS}{[proj(BMI)]for\ ONE-ROOM}$ is an approximation to the percent of change. This outcome remains the same regardless of the age cohort as long as the age of the couples is the same.

[6] The respective 95% confidence intervals are: $-2.44\% \leq ln\frac{[proj(BMI)]for\ FIVE-ROOMS}{[proj(BMI)]for\ ONE-ROOM} \leq -0.21\%$ for females and $0.16\% \leq ln\frac{[proj(BMI)]for\ FIVE-ROOMS}{[proj(BMI)]for\ ONE-ROOM} \leq 1.95\%$ for males. This outcome remains the same regardless of the age cohort as long as the age of the couples is the same.

$\delta_{18} DOMSHELP \times SINGLE\_FAMILY + \delta_{19}\, HHSIZE + \delta_{20}\, HHSIZE \times SINGLE\_FAMILY + \delta_{21}\, BELOW\_17 + \delta_{22}\, BELOW\_17 \times SINGLE\_FAMILY + u_2$

Figure 3 simulates the variation of projected BMI with number of rooms and structure type. The upper (lower) figure shows variation of the aggregated projected BMI of 20-year old women and men with one, two and three children on the same graph.[7] On the lower part of the figure we provide the game-theory matrices for one child, two children and three children. In Appendix C2-C3 (D2-D3), we explain the algorithms for generating *proj*(BMI) separately for women and men, from which Figure 3 is generated.

Figure 3: Variation of Females and Males Projected BMI with the Structure Type and Number of Rooms



Notes: The vertical axis exhibits the aggregated projected BMI for households with one, two and three children below 17 years. The horizontal axis reports the number of rooms on the upper figure and the structure type on the lower figure. Given that there is no female-male conflict of interests, we avoid showing the separate graphs of females and males. The following matrices provide the game theory description of the graph for one, two and three children:

A. One Child

		Women	
		One-Room	Five-Rooms
Men	One-Room	(25.55, 21.96)	(25.55, 21.34)
	Five-Rooms	(24.52, 21.96)	(24.52, 21.34)

		Women	
		Condos	Single-
Men	Condos	(24.91, 21.60)	(24.91, 21.47)
	Single-Family	(25.01, 21.60)	(25.01, 21.47)

[7] As a robustness test we also checked the projections obtained for the 40-year-old cohorts. While compared to the 20-year cohort, all the graphs move upward due to the significant raise in projected BMI with age, the trends shown in Figure 4 for the 20-year-old cohort remain the same.

B. Two Children

		Women	
		One-Room	Five-Rooms
Men	One-Room	(25.55, 22.20)	(25.55, 21.40)
	Five-Rooms	(24.52, 22.20)	(24.52, 21.40)

		Women	
		Condos	Single-
Men	Condos	(24.91, 21.68)	(24.91, 21.54)
	Single-Family	(24.99, 21.68)	(24.99, 21.54)

C. Three Children

		Women	
		One-Room	Five-Rooms
Men	One-Room	(25.55, 22.35)	(25.55, 21.49)
	Five-Rooms	(24.52, 22.35)	(24.52, 21.49)

		Women	
		Condos	Single-
Men	Condos	(24.91, 21.74)	(24.91, 21.62)
	Single-Family	(25.04, 21.74)	(25.04, 21.62)

Results indicate that the optimal choice would be a five-room apartment. The game theory matrices show that unlike the case of the heterosexual couple without children, there is no conflict of interest. If the objective function is a minimal BMI, the dominant strategy leads to the Nash equilibrium, which is identical to the optimal choice. For the female and male with three children, projected BMI drops significantly by 3.94% and 4.12% with relocation from one to five-rooms apartment.[8]

Figure 4 describes two pie charts of the number of rooms and structure type for women and men with at least one child below 17-year old. Referring to the number of rooms, only 34.12%-34.98% chose the optimal option of five-room apartment. Referring to the structure type, the majority, namely, 68.39%-69.05% of the heterosexual couples with at least one child chose the optimal option of a multifamily unit.

4. SUMMARY AND CONCLUSION

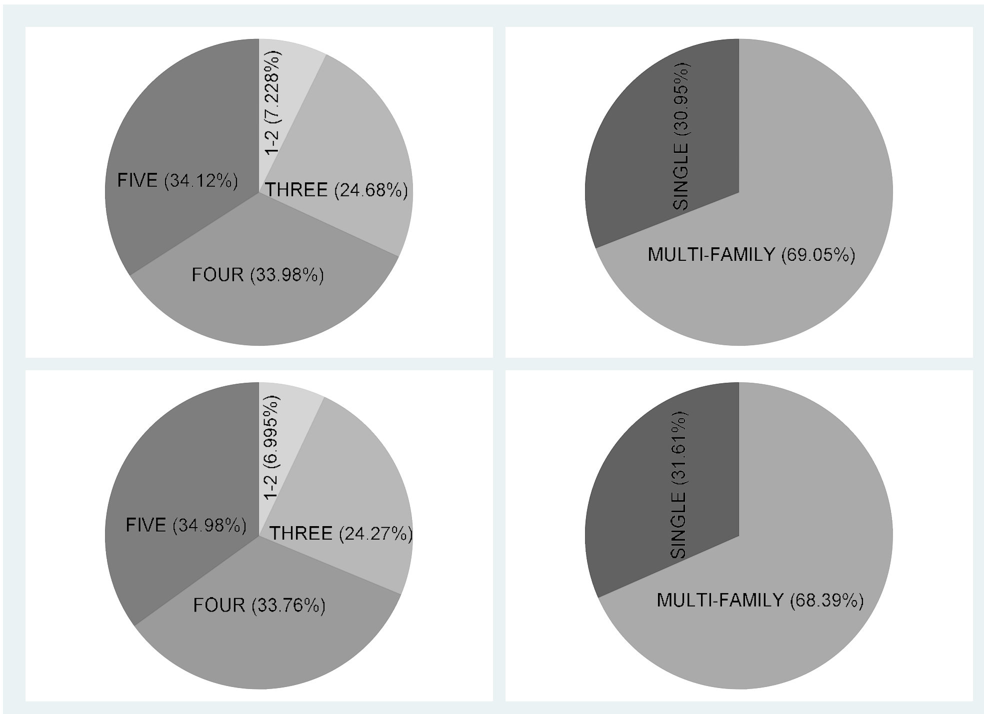
The objective of the current study is to provide a simple long-range decision rule for housing choice that yields an improved health of the occupiers, and compare it to the actual choice. We base this rule on the aggregated minimal BMI, a well-known measure of overweight and obesity. The outcomes of our study suggest that for heterosexual couples without children this rule generates conflict-of-interest in a similar manner to that described by gender-related game theory. Moreover, the actual choice of about one-third of the heterosexual couples without children was the five-rooms apartment, the worst choice from the males perspective, given the support of the null hypothesis of overweight (proj(BMI)≥25) even for 20-year-old males. Referring to the number of room criteria for heterosexual couples with at least one child below 17, once again the optimal choice would be a five-room apartment, yet only one third of the heterosexual couples made the optimal choice.

Obviously, future health problems are only one of the criteria for housing choice. Other important and short-run criteria would almost certainly include affordability. Yet, results of our study may indicate lack of information or awareness to this long-run health issue. It is possible that given the appropriate information, households with children, particularly young couples, would prefer to improve their

[8] The respective 95% confidence intervals are: $-7.48\% \leq ln\frac{[proj(BMI)]for\ FIVE-ROOMS}{[proj(BMI)]for\ ONE-ROOM} \leq -0.40\%$ for females and $-6.64\% \leq ln\frac{[proj(BMI)]for\ FIVE-ROOMS}{[proj(BMI)]for\ ONE-ROOM} \leq -1.60\%$ for males. Note that while the female projected BMI rise with the number of children, the male projected BMI remains unchanged with the number of children.

long-run stature by increasing leverage in an effort of buying a larger apartment.[9] Another possibility is to provide government incentives to buy larger apartments particularly for young couples with children as an indirect way to reduce public health spending on obesity complications in the long run.

Figure 4: Pie-Chart of the Number of Rooms and Structure Type for Heterosexual Couples with Children



Notes: The left-upper (left-lower) chart refers to 2,172 (2,130) observations× years who are defined as married women (men) at work age cohort of 20-62 (20-67) with at least one child below 17-years, belonging to 1,188 (1,151) households. The labels 1-2, THREE, FOUR, FIVE refer to the number of rooms. Rooms include living rooms and bedrooms but not kitchen or bathrooms.
The right-upper (right-lower) chart refers to 2,226 (2,180) observations× years who are defined as married women (men) at work age cohort of 20-62 (20-67) with at least one child below 17-years, belonging to 1,194 (1,156) households. The labels MULTI-FAMILY, SINGLE refer to the structure type. Relative frequencies for each category are given in parentheses.

[9] Note, that 68.94% of the relevant respondents with at least one child below 17 are homeowners.

5. REFERENCES

Arbel, Yuval; Fialkoff, Chaim; and Amichai Kerner (2018) "Does the Housing Unit's Type and Size Affect Health?" *Unpublished Manuscript*, 1-33.

Blackorby and Donaldson (1994) "Measuring the Cost of Children: A Theoretical Framework" Chapter 2: 51-. In: The Measurement of Household Welfare Edited by R. W. Blundell, Ian Preston, Ian Walker, Cambridge University Press.

Creatore, Maria I.; Glazier, Richard H.; Moineddin, Rahim; Fazli, Ghazal S.; Johns, Ashley; Gozdyra, Peter; Matheson, Flora I.; Kaufman-Shriqui, Vered; Rosella, Laura C.; Manuel, Doug G.; Gillian L. Booth (2016) "Association of Neighborhood Walkability with Change in Overweight, Obesity, and Diabetes" JAMA **315(20)**, 2211-2220.

Greene, William H. (2012) *Econometric Analysis*, Seventh Edition. Pearson Education Limited.

Lau, Sau-Him Paul; Vai-Lam Mui (2008) "Using Turn Taking to Mitigate Coordination and Conflict Problems in the Repeated Battle of the Sexes Game" *Theory and Decision* **65**,153–183.

Luce, R.D. and Raiffa, H. (1957) *Games and Decisions: An Introduction and Critical Survey*, Wiley & Sons.

OECD/EU (2016) "Health at a Glance: Europe 2016 – State of Health in the EU Cycle" OECD Publishing, Paris. http://dx.doi.org/10.1787/9789264265592-en

Osborne, Martin J.; and Ariel Rubinstein (1994). *A course in game theory*. The MIT Press.

Qin, Xuezheng and Jay Pan (2016) "The Medical Cost Attributable to Obesity and Overweight in China: Estimation Based on Longitudinal Surveys" *Health Economics* **25**, 1291–1311**.**

Sallis, James F.; Cerin, Ester; Conway, Terry L.; Adams, Marc A.; Frank, Lawrence D. *et. al.* (2016) "Physical Activity in Relation to Urban Environments in 14 Cities Worldwide: a cross-sectional Study" *Lancet* **387**, 2207–2217.

Appendix A1: Regression Analysis Stratified by Number of Rooms and Gender

VARIABLES	(1) full ln(BMI)	(2) step-wise ln(BMI)	(3) full ln(BMI)	(4) step-wise ln(BMI)
Constant	2.9365***	2.9394***	3.0946***	3.0958***
	(0.0286)	(0.0122)	(0.0230)	(0.0107)
PENTHOUSE_DUPLEX	-0.0115	–	0.0046	–
	(0.0109)	–	(0.0096)	–
GARDEN	-0.0031	–	-0.0026	–
	(0.0116)	–	(0.0101)	–
SINGLE_FAMILY	-0.0086	–	0.0074	–
	(0.0065)	–	(0.0052)	–
BALCONY	0.0010	–	0.0014	–
	(0.0055)	–	(0.0044)	–
ROOMS	0.0014	–	0.0086	0.0065***
	(0.0158)	–	(0.0128)	(0.0022)
ROOMS_SQ	-0.0013	-0.0013***	-0.0003	–
	(0.0022)	(0.0004)	(0.0018)	–
AGE	0.0054***	0.0053***	0.0023***	0.0023***
	(0.0002)	(0.0002)	(0.0002)	(0.0002)
MARRIED	0.0149**	0.0151**	0.0460***	0.0409***
	(0.0062)	(0.0061)	(0.0057)	(0.0049)
ARAB	0.0788***	0.0791***	0.0309***	0.0333***
	(0.0073)	(0.0070)	(0.0063)	(0.0056)
OTHER	-0.0016	–	0.0051	–
	(0.0146)	–	(0.0160)	–
IMM_EUROPE_AMERICA	0.0340***	0.0363***	0.0143**	0.0171***
	(0.0075)	(0.0070)	(0.0065)	(0.0060)
IMM_ASIA_AFRICA	-0.0169	–	-0.0193**	–
	(0.0149)	–	(0.0095)	–
DOMSHELP	-0.0022	–	-0.0086	–
	(0.0087)	–	(0.0065)	–
HHSIZE	0.0044**	0.0046***	0.0003	–
	(0.0019)	(0.0016)	(0.0014)	–
BELOW_17	0.0000	–	-0.0002	–
	(0.0001)	–	(0.0001)	–
Gender	FEMALES	FEMALES	MALES	MALES
Observations×Years	4,238	4,238	4,550	4,550
Individuals	2,046	2,046	2,149	2,149
VIF	5.65	1.19	6.47	1.15
R-squared	0.1573	0.1564	0.0918	0.0897
$\hat{\sigma} = \sqrt{MSE}$	0.16862	0.16853	0.14366	0.14367
$\frac{1}{2}\hat{\sigma}^2$	0.01421635	0.01420118	0.0103191	0.01032053
F-statistic	53.67***	132.6***	31.77***	92.16***

Notes: The table displays the outcomes obtained from the estimation of the model given by equation (1) – including the variables ROOMS and ROOMS_SQ, and stratified separately to females and males. The Variance Inflating Factor (VIF) measures the level of collinearity, where VIF above 10 indicates high degree of collinearity. The step-wise procedure gradually omits variables with insignificant coefficients. The procedure is designed to reduce the level of collinearity among independent variables. Robust standard errors are given in parentheses. * significant at the 10% significance level. ** significant at the 5% significance level. *** significant at the 1% significance level.

Appendix A2: Algorithm for Generating Projections for the 20 Year-Old Cohort of Jewish Israeli Married Females without Children Stratified by Number of Rooms

Results from column (2) of Appendix A1 refer only to the group of 2,046 adult females ($20 \leq AGE \leq 62$, where the upper bound is the workforce retirement age), and can be written as follows:

$\text{proj}(\ln(BMI)) = 2.9394 - 0.0013 \cdot ROOMS\_SQ + 0.0053 \cdot AGE + 0.0151 \cdot MARRIED + 0.0791 \cdot ARAB + 0.0363 \cdot IMM\_EUROPE\_AMERICA + 0.0046 HHSIZE$

Substituting $ROOMS\_SQ$=1,4,9,16,25; AGE=20; $MARRIED$=1; $ARAB$=0; $IMM\_EUROPE\_AMERICA = 0$; IMM_ASIA_AFRICA =0; $HHSIZE$=2 yields $\text{proj}(\ln(BMI))$ for 20-year old native-Israeli married Jewish female living jointly with her husband in one, two, three, four, five-room apartment**.**

Consider, for example, projection for the five-room apartment:

$\text{proj}(\ln(BMI)) = 2.9394 - 0.0013 \cdot 25 + 0.0053 \cdot 20 + .0151 \cdot 1 + 0.0791 \cdot 0 + 0.0363 \cdot 0 + 0.0046 \cdot 2 = 3.0372$

The following table provides the difference between manually calculated projections ($\text{proj}(\ln(BMI))$) and those produced by Stata software package with higher level of precision:

Rooms	manual	Software Package
1	3.0684	3.068748
2	3.0645	3.064793
3	3.058	3.0582
4	3.0489	3.04897
5	3.0372	3.037104

Obviously, we use $\text{proj}(\ln(BMI))$ obtained from the method that produce the figures with the highest precision, namely, those produced by Stata software package.

According to econometric textbooks (e.g., Greene, 2012: 121-122), the formula to generate proj(BMI) from $\text{proj}(\ln(BMI))$ is $\exp(\text{proj}(\ln(BMI)) \cdot \exp(\frac{1}{2}\hat{\sigma}^2)$ where $\hat{\sigma} = \sqrt{MSE}$ of each regression:

Rooms	(1) = $\exp(\text{proj}(\ln(BMI)))$	(2)=$\exp(\frac{1}{2}\hat{\sigma}^2)$	(3)=(1)·(2)
1	exp(3.068748)= 21.514949	$\exp(0.01420118) = 1.0143025$	21.822667
2	exp(3.064793)= 21.430026	$\exp(0.01420118) = 1.0143025$	21.736528
3	exp(3.0582)= 21.289202	$\exp(0.01420118) = 1.0143025$	21.593691
4	exp(3.04897)= 21.093607	$\exp(0.01420118) = 1.0143025$	21.395298
5	exp(3.037104)= 20.844789	$\exp(0.01420118) = 1.0143025$	21.142922

The left-middle side of Figure 1 is based on this table, where the vertical axis is column (3), and the horizontal axis is the number of rooms.

Appendix A3: Algorithm for Generating Projections for the 20 Year-Old Cohort of Jewish Israeli Married Males without Children Stratified by Number of Rooms

Results from column (4) of Appendix A1 refer only to the group of 2,149 adult males ($20 \leq AGE \leq 67$, where the upper bound is the workforce retirement age), and can be written as follows:

$$\text{proj}(\ln(BMI)) = 3.0958 + 0.0065 \cdot ROOMS + 0.0023 \cdot AGE + 0.0409 \cdot MARRIED + 0.0333 \cdot ARAB + 0.0171 \cdot IMM\_EUROPE\_AMERICA$$

Substituting $ROOMS$=1,2,3,4,5; AGE=20; $MARRIED$=1; $ARAB$=0; $IMM\_EUROPE\_AMERICA = 0$ yields $\text{proj}(\ln(BMI))$ for 20-year old native-Israeli married Jewish male living jointly with his wife in one, two, three, four, five-room apartment**.**

Consider, for example, projection for the five-room apartment:

$$\text{proj}(\ln(BMI)) = 3.0958 + 0.0065 \cdot 5 + 0.0023 \cdot 20 + 0.0409 \cdot 1 + 0.0333 \cdot 0 + 0.0171 \cdot 0 = 3.2152$$

The following table provides the difference between manually calculated projections ($\text{proj}(\ln(BMI))$) and those produces by Stata software package with higher level of precision:

Rooms	Manual	Software Package
1	3.1892	3.189595
2	3.1957	3.196108
3	3.2022	3.202621
4	3.2087	3.209134
5	3.2152	3.215647

Obviously, we use $\text{proj}(\ln(BMI))$ obtained from the method that produce the figures with the highest precision, namely, those produced by Stata software package.

The formula to generate proj(BMI) from $\text{proj}(\ln(BMI))$ is $\exp(\text{proj}(\ln(BMI)) \cdot \exp(\frac{1}{2}\hat{\sigma}^2)$:

Rooms	(1) = $\exp(\text{proj}(\ln(BMI)))$	(2)=$\exp(\frac{1}{2}\hat{\sigma}^2)$	(3)=(1)·(2)
1	exp(3.189595)=24.278593	$\exp(0.01032053) = 1.010374$	24.530459
2	exp(3.196108)= 24.437235	$\exp(0.01032053) = 1.010374$	24.690747
3	exp(3.202621)=24.596914	$\exp(0.01032053) = 1.010374$	24.852082
4	exp(3.209134)=24.757637	$\exp(0.01032053) = 1.010374$	25.014473
5	exp(3.215647)=24.91941	$\exp(0.01032053) = 1.010374$	25.177924

The left-bottom side of Figure 1 is based on this table, where the vertical axis is column (3), and the horizontal axis is the number of rooms.

Appendix B1: Regression Analysis Stratified by Type of Dwelling Unit and Gender of the Resident

VARIABLES	(1) full ln(BMI)	(2) step-wise ln(BMI)	(3) full ln(BMI)	(4) step-wise ln(BMI)
Constant	2.9325***	2.9319***	3.1127***	3.1148***
	(0.0120)	(0.0117)	(0.0094)	(0.0074)
PENTHOUSE_DUPLEX	-0.0157	–	0.0085	–
	(0.0105)	–	(0.0096)	–
GARDEN	-0.0051	–	-0.0002	–
	(0.0114)	–	(0.0099)	–
BALCONY	-0.0028	–	0.0040	–
	(0.0053)	–	(0.0044)	–
SINGLE_FAMILY	-0.0152**	-0.0133**	0.0111**	0.0106**
	(0.0060)	(0.0057)	(0.0048)	(0.0046)
AGE	0.0053***	0.0052***	0.0023***	0.0023***
	(0.0002)	(0.0002)	(0.0002)	(0.0002)
MARRIED	0.0129**	0.0136**	0.0467***	0.0433***
	(0.0062)	(0.0060)	(0.0056)	(0.0048)
ARAB	0.0848***	0.0856***	0.0269***	0.0304***
	(0.0068)	(0.0064)	(0.0060)	(0.0054)
OTHER	0.0027	–	-0.0004	–
	(0.0144)	–	(0.0155)	–
IMM_EUROPE_AMERICA	0.0337***	0.0362***	0.0164**	0.0187***
	(0.0074)	(0.0070)	(0.0065)	(0.0060)
IMM_ASIA_AFRICA	-0.0183	–	-0.0189**	–
	(0.0148)	–	(0.0095)	–
DOMSHELP	-0.0042	–	-0.0074	–
	(0.0085)	–	(0.0064)	–
HHSIZE	0.0030*	0.0034**	0.0013	–
	(0.0018)	(0.0016)	(0.0014)	–
BELOW_17	0.0001	–	-0.0002	–
	(0.0001)	–	(0.0001)	–
Gender	FEMALES	FEMALES	MALES	MALES
Observations×Years	4,318	4,318	4,636	4,636
Individuals	2,048	2,048	2,154	2,154
VIF	1.23	1.13	1.32	1.12
R-squared	0.1541	0.1532	0.0908	0.0892
$\hat{\sigma} = \sqrt{MSE}$	0.16927	0.16923	0.14392	0.14393
$\frac{1}{2}\hat{\sigma}^2$	0.01432617	0.0143194	0.01035648	0.01035792
F-statistic	62.55***	134.55***	37.06***	94.54***

Notes: The table displays the outcomes obtained from the estimation of the model given by equation (1) – excluding the variables ROOMS and ROOMS_SQ, and stratified separately to females and males. The Variance Inflating Factor (VIF) measures the level of collinearity, where VIF above 10 indicates high degree of collinearity. The step-wise procedure gradually omits variables with insignificant coefficients. The procedure is designed to reduce the level of collinearity among independent variables. Robust standard errors are given in parentheses. * significant at the 10% significance level. ** significant at the 5% significance level. *** significant at the 1% significance level.

Appendix B2: Algorithm for Generating Projections for the 20 Year-Old Cohort of Jewish Israeli Married Females without Children (Single-Family vs. Multi-Family Housing Units)

Results from column (2) of Appendix B1 refer only to the group of 2,048 adult females ($20 \leq AGE \leq 62$, where the upper bound is the workforce retirement age), and can be written as follows:

$$\text{proj}(\ln(BMI)) = 2.9319 - 0.0133 \cdot SINGLE\_FAMILY + 0.0052 \cdot AGE + 0.0136 \cdot MARRIED + 0.0856 \cdot ARAB + 0.0362 \cdot IMM\_EUROPE\_AMERICA + 0.0034 \cdot HHSIZE$$

Substituting: $SINGLE\_FAMILY$=0,1; AGE=20; $MARRIED$=1; $ARAB$=0; $IMM\_EUROPE\_AMERICA = 0$ yields $\text{proj}(\ln(BMI))$ for 20-year old native-Israeli married Jewish male living jointly with his wife in condominium apartment vs. single-family unit**.**

Consider, for example, projection for the multi-family apartment:

$$\text{proj}(\ln(BMI)) = 2.9319 - 0.0133 \cdot 0 + 0.0052 \cdot 20 + 0.0136 \cdot 1 + 0.0856 \cdot 0 + 0.0362 \cdot 0 + 0.0034 \cdot 2 = 3.0563$$

And projection for a single-family unit:

$$\text{proj}(\ln(BMI)) = 2.9319 - 0.0133 \cdot 1 + 0.0052 \cdot 20 + 0.0136 \cdot 1 + 0.0856 \cdot 0 + 0.0362 \cdot 0 + 0.0034 \cdot 2 = 3.043$$

The following table provides the difference between manually calculated projections ($\text{proj}(\ln(BMI))$) and those produced by Stata software package:

Single-Family	Manual	Software Package
0	3.0563	3.056705
1	3.043	3.043443

Finally, we apply the formula to generate proj(BMI) from $\text{proj}(\ln(BMI))$:

Single-Family	(1) $= \exp(\text{proj}(\ln(BMI)))$	(2)=$\exp(\frac{1}{2}\hat{\sigma}^2)$	(3)=(1)·(2)
0	exp(3.056705)= 21.257399	$\exp(0.0143194) = 1.0144224$	21.563981
1	exp(3.043443)= 20.977344	$\exp(0.0143194) = 1.0144224$	21.279888

The right-middle side of Figure 1 is based on this table, where the vertical axis is column (3), and the horizontal axis is *SINGLE_FAMILY*=0,1.

Appendix B3: Algorithm for Generating Projections for the 20 Year-Old Cohort of Jewish Israeli Married Males without Children (Single-Family vs. Multi-Family Housing Units)

Results from column (4) of Appendix B1 refer only to the group of 2,046 adult males ($20 \leq AGE \leq 67$, where the upper bound is the workforce retirement age), and can be written as follows:

$$\text{proj}(\ln(BMI)) = 3.1148 + 0.0106 \cdot SINGLE\_FAMILY + 0.0023 \cdot AGE + 0.0433 \cdot MARRIED + 0.0304 \cdot ARAB + 0.0187 \cdot IMM\_EUROPE\_AMERICA$$

Substituting $SINGLE\_FAMILY$=0,1; AGE=20; $MARRIED$=1; $ARAB$=0; $IMM\_EUROPE\_AMERICA = 0$; yields $\text{proj}(\ln(BMI))$ for 20-year old native-Israeli married Jewish female living jointly with her husband in condominium apartment vs. single-family unit**.**

Consider, for example, projection for the multi-family apartment:

$$\text{proj}(\ln(BMI)) = 3.1148 + 0.0106 \cdot 0 + 0.0023 \cdot 20 + 0.0433 \cdot 1 + 0.0304 \cdot 0 + 0.0187 \cdot 0 = 3.2041$$

And projection for a single-family unit:

$$\text{proj}(\ln(BMI)) = 2.9340 - 0.0130 \cdot 1 + 0.0051 \cdot 20 + 0.0182 \cdot 1 + 0.0485 \cdot 0 + 0.0845 \cdot 0 + 0.0365 \cdot 0 + 0.0032 \cdot 2 = 3.2147$$

The following table provides the difference between manually calculated projections ($\text{proj}(\ln(BMI))$) and those produced by Stata software package:

Single-Family	Manual	Software Package
0	3.2041	3.204856
1	3.2147	3.215421

Finally, we apply the formula to generate proj(BMI) from $\text{proj}(\ln(BMI))$:

Single-Family	$(1) = \exp(\text{proj}(\ln(BMI)))$	(2)=$\exp(\frac{1}{2}\hat{\sigma}^2)$	(3)=(1)·(2)
0	exp(3.204856)=24.65195	$\exp(0.01035792) = 1.0104117$	24.90862
1	exp(3.215421)=24.913778	$\exp(0.01035792) = 1.0104117$	25.173174

The right-bottom side of Figure 1 is based on this table, where the vertical axis is column (3), and the horizontal axis is *SINGLE_FAMILY*=0,1.

Appendix C1: Regression Analysis Stratified by Number of Rooms and Gender

VARIABLES	(1) full ln(BMI)	(2) step-wise ln(BMI)	(3) full ln(BMI)	(4) step-wise ln(BMI)
Constant	2.916***	2.919***	3.132***	3.145***
	(0.0463)	(0.0120)	(0.0359)	(0.00786)
PENTHOUSE_DUPLEX	-0.0123	–	0.00380	–
	(0.0108)	–	(0.00972)	–
GARDEN	-0.00222	–	-0.00292	–
	(0.0116)	–	(0.0102)	–
SINGLE_FAMILY	-0.00981	–	0.00653	–
	(0.00651)	–	(0.00525)	–
BALCONY	0.00115	–	0.00161	–
	(0.00553)	–	(0.00446)	–
ROOMS	0.00702	–	0.00127	–
	(0.0188)	–	(0.0149)	–
ROOMS_SQ	-0.00143	–	-0.00110	-0.00163***
	(0.00244)	–	(0.00203)	(0.000504)
AGE	0.00596***	0.00613***	0.000307	–
	(0.000868)	(0.000441)	(0.000738)	–
AGE×ROOMS	-0.000155	-0.000218**	0.000550***	0.000642***
	(0.000226)	(9.08e-05)	(0.000194)	(4.69e-05)
MARRIED	0.0156	0.0157**	0.0925***	0.0872***
	(0.0234)	(0.00625)	(0.0208)	(0.0170)
MARRIED×ROOMS	0.000176	–	-0.0137**	-0.0133***
	(0.00613)	–	(0.00564)	(0.00449)
ARAB	0.0603**	0.0789***	0.0642***	0.0310***
	(0.0277)	(0.00704)	(0.0244)	(0.00566)
ARAB×ROOMS	0.00591	–	-0.00930	–
	(0.00735)	–	(0.00665)	–
OTHER	0.0752	–	0.0676	–
	(0.0565)	–	(0.0508)	–
OTHER×ROOMS	-0.0250	–	-0.0199	–
	(0.0156)	–	(0.0151)	–
IMM_EUROPE_AMERICA	0.0509*	0.0367***	0.0238	0.0163***
	(0.0287)	(0.00700)	(0.0260)	(0.00607)
EUROPE×ROOMS	-0.00423	–	-0.00218	–
	(0.00706)	–	(0.00632)	–
IMM_ASIA_AFRICA	0.104*	–	0.0372	–
	(0.0617)	–	(0.0412)	–
ASIA×ROOMS	-0.0322**	–	-0.0143	-0.00529**
	(0.0151)	–	(0.0101)	(0.00230)
DOMSHELP	-0.0297	–	-0.0105	–
	(0.0433)	–	(0.0268)	–
HHSIZE	0.00659	–	0.000117	–
	(0.00963)	–	(0.00620)	–
HHSIZE×ROOMS	0.00251	0.125×10^{-2}**	-0.000396	–
	(0.00189)	(0.0005)	(0.00156)	–
BELOW_17	0.00109**	0.0758×10^{-2}**	-0.000707	–
	(0.000514)	(0.0004)	(0.000487)	–
BELOW_17×ROOMS	-0.000278**	-0.0195×10^{-2}**	0.000150	–
	(0.000129)	(9.01×10^{-5}**)	(0.000123)	–

VARIABLES	(1) full ln(BMI)	(2) step-wise ln(BMI)	(3) full ln(BMI)	(4) step-wise ln(BMI)
Gender	FEMALE	FEMALE	MALE	MALE
Interaction with Rooms	YES	YES	YES	YES
Observations×Years	4,238	4,238	4,550	4,550
Individuals	2,046	2,046	2,149	2,149
VIF	21.64	5.18	23.47	5.78
R-squared	0.161	0.157	0.095	0.092
$\hat{\sigma} = \sqrt{MSE}$	0.168	0.1685	0.144	0.14349
$\frac{1}{2}\hat{\sigma}^2$	0.014112	0.01419613	0.010368	0.01029469
F-statistic	35.28***	101.20***	21.30***	68.61***

Notes: The table displays the outcomes obtained from the estimation of the model given by equation (2). The Variance Inflating Factor (VIF) measures the level of collinearity, where VIF above 10 indicates high degree of collinearity. The step-wise procedure gradually omits variables with insignificant coefficients. The procedure is designed to reduce the level of collinearity among independent variables. Robust standard errors are given in parentheses. * significant at the 10% significance level. ** significant at the 5% significance level. *** significant at the 1% significance level.

Appendix C2: Algorithm for Generating Projections for the 20 Year-Old Cohort pf Jewish Israeli Married Females Stratified by Number of Children and Rooms

Results from column (2) of Appendix C1 refer only to the group of 2,046 adult females ($20 \leq AGE \leq 62$, where the upper bound is the workforce retirement age), and can be written as follows:

$\text{proj}(\ln(BMI)) = 2.919 + 0.00613 \times AGE - 0.000218 \times AGE \times ROOMS + 0.0157 \times MARRIED + 0.0789 \times ARAB + 0.0367 \times IMM\_EUROPE\_AMERICA + 0.00125 \times HHSIZE \times ROOMS + 0.000758 \times BELOW\_17 - 0.000195 \times BELOW\_17 \times ROOMS$

The $BELOW\_17$ variable equals the ratio between the number of children and the number of persons in the household and multiplied by 100. The following table provides the conversion between the number of children and $BELOW\_17$:

CHILDREN	1	2	3
HHSIZE= *CHILDREN*+2 Persons	3	4	5
$BELOW\_17 = 100 \cdot \frac{CHILDREN}{HHSIZE}$	$100 \cdot \frac{1}{3} = 33\frac{1}{3}$	$100 \cdot \frac{2}{4} = 50$	$100 \cdot \frac{3}{5} = 60$

Substituting AGE=20; $AGE \times ROOMS = 20{,}40{,}60{,}80{,}100$ $MARRIED$=1; $ARAB$=0; $HHSIZE \times ROOMS = 3{,}4{,}5$ (one-room); $6{,}8{,}10$ (two-rooms); $9{,}12{,}15$ (three-rooms); $12{,}16{,}20$ (four-rooms); $15{,}20{,}25$ (four-rooms); $BELOW\_17 = 33\frac{1}{3}, 50{,}60$; $BELOW\_17 \times ROOMS$=$33\frac{1}{3}, 50{,}60$ (one-room) $66\frac{2}{3}, 100{,}120$ (two rooms) $100{,}150{,}180$ (three rooms); $133\frac{1}{3}, 200{,}240$ (four rooms); $166\frac{2}{3}, 250{,}300$ (five rooms) yield the following projections of $\ln(BMI)$:

Rooms	$CHILDREN = 1$; $BELOW\_17 = 33\frac{1}{3}$	$CHILDREN = 2$; $BELOW\_17 = 50$	$CHILDREN = 3$; $BELOW\_17 = 60$
1	3.075206	3.085834	3.092708
2	3.068066	3.076686	3.082853
3	3.060927	3.067538	3.072998
4	3.053788	3.05839	3.063143
5	3.046648	3.049242	3.053288

The formula to generate proj(BMI) from $\text{proj}(\ln(BMI))$ is $\exp(\text{proj}(\ln(BMI)) \cdot \exp(\frac{1}{2}\hat{\sigma}^2)$ where $\hat{\sigma} = \sqrt{MSE}$ =0.1685. Application of this formula yields the following projections of BMI:

Rooms	$CHILDREN = 1$; $BELOW\_17 = 33\frac{1}{3}$	$CHILDREN = 2$; $BELOW\_17 = 50$	$CHILDREN = 3$; $BELOW\_17 = 60$
1	21.963942	22.19862	22.351739
2	21.807678	21.996473	22.132544
3	21.652548	21.796167	21.915499
4	21.498521	21.597685	21.700583
5	21.345568	21.40101	21.487774

The graph at the top of Figure 3 is based on aggregation of the projections reported in Appendix C2-C3. The bottom-left part of Figure 3 reports the projections for the one-room and five-room apartments given above.

Appendix C3: Algorithm for Generating Projections for the 20 Year-Old Cohort pf Jewish Israeli Married Males Stratified by Number of Children and Rooms

Results from column (4) of Appendix C1 refer only to the group of 2,149 adult males ($20 \leq AGE \leq 67$, where the upper bound is the workforce retirement age), and can be written as follows:

$\text{proj}(\ln(BMI)) = 3.145 - 0.00163 \times ROOMS\_SQ + 0.000642 \times AGE \times ROOMS + 0.0872 \times MARRIED - 0.0133 \times MARRIED \times ROOMS + 0.0310 \times ARAB + 0.0163 \times IMM\_EUROPE\_AMERICA - 0.00529 \times ASIA \times ROOMS$

Substituting $ROOMS\_SQ$=1,4,9,16,25; $AGE \times ROOMS$=20,40,60,80,100; $MARRIED$=1; $MARRIED \times ROOMS = 1,2,3,4,5$; $ARAB$=0; $IMM\_EUROPE\_AMERICA = 0$; $ASIA \times ROOMS$ =0; yields $\text{proj}(\ln(BMI))$ for 20-year old native-Israeli married Jewish male living jointly with his wife in one, two, three, four, five-room apartment**:**

Rooms	Software Package
1	3.230405
2	3.225005
3	3.216338
4	3.204405
5	3.189204

The formula to generate proj(BMI) from $\text{proj}(\ln(BMI))$ is $\exp(\text{proj}(\ln(BMI)) \cdot \exp(\frac{1}{2}\hat{\sigma}^2)$ where $\hat{\sigma} = \sqrt{MSE}$ =0.169. Application of this formula yields the following projections of BMI:

Rooms	(1) = $\exp(\text{proj}(\ln(BMI)))$	(2)=$\exp(\frac{1}{2}\hat{\sigma}^2)$	(3)=(1)·(2)
1	exp(3.230405)=25.289897	$\exp(0.01029469) = 1.0103479$	25.551594
2	exp(3.225005)=25.1537	$\exp(0.01029469) = 1.0103479$	25.413987
3	exp(3.216338)=24.936635	$\exp(0.01029469) = 1.0103479$	25.194676
4	exp(3.204405)=24.640834	$\exp(0.01029469) = 1.0103479$	24.895814
5	exp(3.189204)=24.269102	$\exp(0.01029469) = 1.0103479$	24.520235

The graph at the top of Figure 3 is based on aggregation of the projections reported in Appendix C2-C3. The bottom-left part of Figure 3 reports the projections for the one-room and five-room apartments given above.

Appendix D1: Regression Analysis Stratified by Type of Dwelling Unit and Gender of the Resident

VARIABLES	(1) full ln(BMI)	(2) step-wise ln(BMI)	(3) full ln(BMI)	(4) step-wise ln(BMI)
Constant	2.918***	2.927***	3.116***	3.113***
	(0.0139)	(0.0116)	(0.0110)	(0.00754)
PENTHOUSE_DUPLEX	-0.0142	–	0.00870	–
	(0.0105)	–	(0.00959)	–
GARDEN	-0.00412	–	0.000992	–
	(0.0114)	–	(0.0100)	–
BALCONY	-0.00304	–	0.00428	–
	(0.00537)	–	(0.00438)	–
SINGLE_FAMILY	0.0306	–	-0.00284	–
	(0.0267)	–	(0.0211)	–
AGE	0.00560***	0.00537***	0.00239***	0.00238***
	(0.000282)	(0.000233)	(0.000234)	(0.000178)
AGE×SINGLE_FAMILY	-0.00110**	-0.000303**	-0.000144	–
	(0.000537)	(0.000135)	(0.000428)	–
MARRIED	0.0128*	0.0143**	0.0461***	0.0443***
	(0.00722)	(0.00599)	(0.00662)	(0.00495)
MARRIED×SINGLE_FAMILY	0.00963	–	0.00243	–
	(0.0140)	–	(0.0124)	–
ARAB	0.0912***	0.0847***	0.0289***	0.0293***
	(0.00806)	(0.00648)	(0.00722)	(0.00541)
ARAB×SINGLE_FAMILY	-0.0196	–	-0.00469	–
	(0.0151)	–	(0.0127)	–
OTHER	0.00381	–	0.00424	–
	(0.0154)	–	(0.0168)	–
OTHER×SINGLE_FAMILY	-0.0571	–	-0.0292	–
	(0.0396)	–	(0.0430)	–
IMM_EUROPE_AMERICA	0.0413***	0.0346***	0.0126	0.0177***
	(0.00848)	(0.00695)	(0.00764)	(0.00596)
EUROPE×SINGLE_FAMILY	-0.0258	–	0.0160	–
	(0.0176)	–	(0.0143)	–
IMM_ASIA_AFRICA	0.0103	–	-0.0102	–
	(0.0160)	–	(0.0113)	–
ASIA×SINGLE_FAMILY	-0.118***	-0.109***	-0.0236	-0.0359**
	(0.0359)	(0.0311)	(0.0207)	(0.0164)
DOMSHELP	-0.00714	–	-0.0124	–
	(0.0120)	–	(0.00855)	–
DOMSHELP×SINGLE_FAMILY	0.00648	–	0.00895	–
	(0.0169)	–	(0.0128)	–
HHSIZE	0.00194	0.00328**	-0.000497	–
	(0.00201)	(0.00155)	(0.00159)	–
HHSIZE×SINGLE_FAMILY	0.00349	–	0.00655**	0.00546***
	(0.00428)	–	(0.00312)	(0.00158)
BELOW_17	0.000156	–	-9.12e-05	–
	(0.000152)	–	(0.000143)	–
BELOW_17×SINGLE_FAMILY	-0.000305	–	-0.000322	-0.000368**
	(0.000278)	–	(0.000247)	(0.000183)

VARIABLES	(1) full ln(BMI)	(2) step-wise ln(BMI)	(3) full ln(BMI)	(4) step-wise ln(BMI)
Gender	FEMALE	FEMALE	MALE	MALE
Interaction with single-family	YES	YES	YES	YES
Observations×Years	4,318	4,318	4,636	4,636
Individuals	2,048	2,048	2,154	2,154
VIF	4.19	1.14	4.24	1.62
R-squared	0.159	0.157	0.092	0.091
$\hat{\sigma} = \sqrt{MSE}$	0.16893	0.16891	0.14393	0.1438
$\frac{1}{2}\hat{\sigma}^2$	0.01426867	0.01426529	0.01035792	0.01033922
F-statistic	38.49***	119.4***	22.58***	68.91***

Notes: The table displays the outcomes obtained from the estimation of the model given by equation (3). The Variance Inflating Factor (VIF) measures the level of collinearity, where VIF above 10 indicates high degree of collinearity. The step-wise procedure gradually omits variables with insignificant coefficients. The procedure is designed to reduce the level of collinearity among independent variables. Robust standard errors are given in parentheses. * significant at the 10% significance level. ** significant at the 5% significance level. *** significant at the 1% significance level.

Appendix D2: Algorithm for Generating Projections for the 20 Year-Old Cohort of Jewish Israeli Married Females without Children (Single-Family vs. Multi-Family Housing Units)

Results from column (2) of Appendix D1 refer only to the group of 2,048 adult females ($20 \leq AGE \leq 62$, where the upper bound is the workforce retirement age), and can be written as follows:

$\text{proj}(\ln(BMI)) = 2.927 + 0.00537 \times AGE - 0.000303 \times AGE \times SINGLE\_FAMILY + 0.0143 \times MARRIED + 0.0847 \times ARAB + 0.0346 \times IMM\_EUROPE\_AMERICA - 0.109 \times ASIA \times SINGLE\_FAMILY + 0.00328 \times HHSIZE$

Substituting:AGE=20; $AGE \times SINGLE\_FAMILY = 0{,}20$ $MARRIED$=1; $ARAB$=0; $IMM\_EUROPE\_AMERICA = 0$; $ASIA \times SINGLE\_FAMILY = 0$; $HHSIZE = 3{,}4{,}5$ yield the following projections of $\ln(BMI)$:

SINGLE_FAMILY	$CHILDREN = 1;$ $HHSIZE = 3$	$CHILDREN = 2;$ $HHSIZE = 4$	$CHILDREN = 3;$ $HHSIZE = 5$
0	3.058658	3.061936	3.065214
1	3.052595	3.055873	3.059151

The formula to generate proj(BMI) from proj($\ln(BMI)$) is $\exp(\text{proj}(\ln(BMI)) \cdot \exp(\frac{1}{2}\hat{\sigma}^2)$ where $\hat{\sigma} = \sqrt{MSE}$ =0.1685. Application of this formula yields the following projections of BMI:

SINGLE_FAMILY	$CHILDREN = 1;$ $HHSIZE = 3$	$CHILDREN = 2;$ $HHSIZE = 4$	$CHILDREN = 3;$ $HHSIZE = 5$
0	21.604968	21.675905	21.747076
1	21.474374	21.544882	21.615622

The graph at the middle of figure 3 is based on aggregation of the projections reported in Appendix D2-D3. The bottom-right part of figure 3 reports the projections for *SINGLE_FAMILY*=0,1.

Appendix D3: Algorithm for Generating Projections for the 20 Year-Old Cohort of Jewish Israeli Married Males without Children (Single-Family vs. Multi-Family Housing Units)

Results from column (4) of Appendix D1 refer only to the group of 2,154 adult females ($20 \leq AGE \leq 67$, where the upper bound is the workforce retirement age), and can be written as follows:

$$\text{proj}(\ln(BMI)) = 3.113 + 0.00238 \times AGE + 0.0443 \times MARRIED + 0.0293 \times ARAB + 0.0177 \times IMM\_EUROPE\_AMERICA - 0.0359 \times ASIA \times SINGLE\_FAMILY + 0.00546 \times HHSIZE \times SINGLE\_FAMILY - 0.000368 \times BELOW\_17 \times SINGLE\_FAMILY$$

The $BELOW\_17$ variable equals the ratio between the number of children and the number of persons in the household and multiplied by 100. The following table provides the conversion between the number of children and $BELOW\_17$:

CHILDREN	1	2	3
HHSIZE= *CHILDREN*+2 Persons	3	4	5
$BELOW\_17 = 100 \cdot \frac{CHILDREN}{HHSIZE}$	$100 \cdot \frac{1}{3} = 33\frac{1}{3}$	$100 \cdot \frac{2}{4} = 50$	$100 \cdot \frac{3}{5} = 60$

Substituting: AGE=20; $MARRIED$=1; $ARAB$=0; $IMM\_EUROPE\_AMERICA = 0$; $ASIA \times SINGLE\_FAMILY = 0$; $HHSIZE \times SINGLE\_FAMILY$ =0 for multi-family units, and 3,4,5 for single-family units; $BELOW\_17 \times SINGLE\_FAMILY = 0$ for multi-family units, and $33\frac{1}{3}$, 50,60 for single-family units yield the following projections of $\ln(BMI)$:

SINGLE_FAMILY	$CHILDREN = 1$; $HHSIZE = 3$; $BELOW\_17 = 33\frac{1}{3}$	$CHILDREN = 2$; $HHSIZE = 4$; $BELOW\_17 = 50$	$CHILDREN = 3$; $HHSIZE = 5$; $BELOW\_17 = 60$
0	3.20474	3.20474	3.20474
1	3.208846	3.208167	3.209945

The formula to generate proj(BMI) from proj($\ln(BMI)$) is $\exp(\text{proj}(\ln(BMI)) \cdot \exp(\frac{1}{2}\hat{\sigma}^2)$ where $\hat{\sigma} = \sqrt{MSE}$ =0.1438. Application of this formula yields the following projections of BMI:

SINGLE_FAMILY	$CHILDREN = 1$; $HHSIZE = 3$; $BELOW\_17 = 33\frac{1}{3}$	$CHILDREN = 2$; $HHSIZE = 4$; $BELOW\_17 = 50$	$CHILDREN = 3$; $HHSIZE = 5$; $BELOW\_17 = 60$
0	24.905265	24.905265	24.905265
1	25.007736	24.990762	25.035235

The graph at the middle of Figure 3 is based on aggregation of the projections reported in Appendix D2-D3. The bottom-right part of Figure 3 reports the projections for *SINGLE_FAMILY*=0,1.