Israel Economic Review Vol. 7, No. 1 (2009), 143–176

THE EFFECT OF CHANGES IN WAGES, GDP, AND WORKERS' DEMOGRAPHIC CHARACTERISTICS ON WORKING HOURS[1]

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Abstract

In this study we estimate the effect of changes in the employee's offered wage – which is influenced by macroeconomic developments and changes in tax rates – on working hours, accounting for changes in the employee's personal circumstances (family status and composition, entering or exiting school, reaching the pension age and spousal income and employment). We use repeat observations of workers in Israeli labor-force surveys to identify workers at more than one point in time. With the help of these data, we also examine whether the elasticities differ between population groups distinguished by demographic characteristics, schooling, employment characteristics in the first period and family income. The estimation shows that wage changes have little effect on working hours and, among full-time employees, have no effect at all. In contrast, working hours are quite elastic to changes in GDP. Among men, other than those from low-income families, this elasticity surpasses the elasticity in the extensive margin. Among women, working hours' elasticity to GDP growth is positive only among new entrants to the labor market, those approaching the retirement age, and those in low-wage occupations. However, in these groups – about one-third of working women - the elasticity was twice that found among men.

1. INTRODUCTION

One of the most important questions in labor-market analysis is: how powerful is employment's response to changes in demand and policies such as tax-rate changes and employment laws? This response is composed of extensive elasticity, i.e., entries to and departures from employment, and intensive elasticity, i.e., a change in the working hours of those already working. These elasticities are important in profiling the labor market's response to changes in the business cycle and in policies, and in understanding their effect

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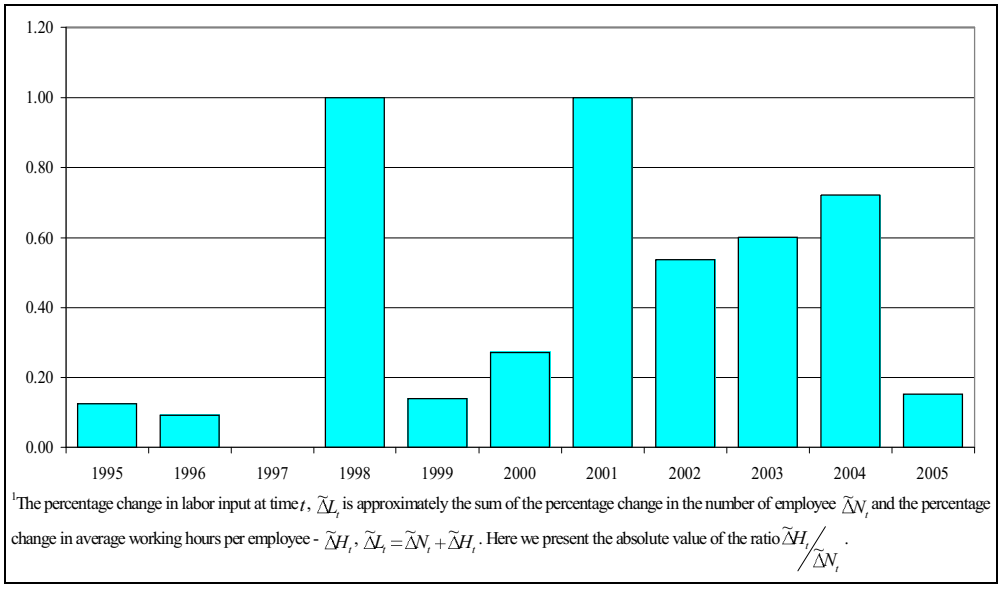
We thank Moshe Sani for his immense contribution to the development of the database used in this study and Yehuda Porath for bibliographical help. Comments by Nitza Kasir and participants in the Bank of Israel Research Department's seminar and the 2007 conference of the Israeli Economics Association are gratefully acknowledged.

on the development of inflationary pressures and income distribution. In Israel, quite a few studies dealt with the extensive elasticity but research on the intensive elasticity has been scanty.

Changes in working hours are of considerable quantitative importance. In the past decade, their period-on-period variance accounted for much of the short-term change in labor input, and the effect of year-on-year changes in average working hours per person employed is more than half of the effect of changes in employment (although not always in the same direction, Figure 1).[2] Furthermore, given that new entrants to the labor market work, on average, 80 percent of the hours of those steadily employed (Brender & Strawczynski, 2006), the share of changes in the hours of the steadily employed in the total change in labor input is even greater. Apart from the total change, different groups of workers exhibit differences in the long-term trend and period-to-period change in their working hours (Figure 2); these differences may affect income distribution in a way that surpasses the effects of changes in the employment rate and the hourly wage.

Given the appreciable weight of changes in working hours in the total change in labor input, understanding the factors that affect working hours may enhance our understanding of important processes in the labor market. The elasticity of working hours to wages may help analyzing the intensity of the wage mechanism in the elimination of demand and supply surpluses in the labor market; it is also central for understanding the potential effect

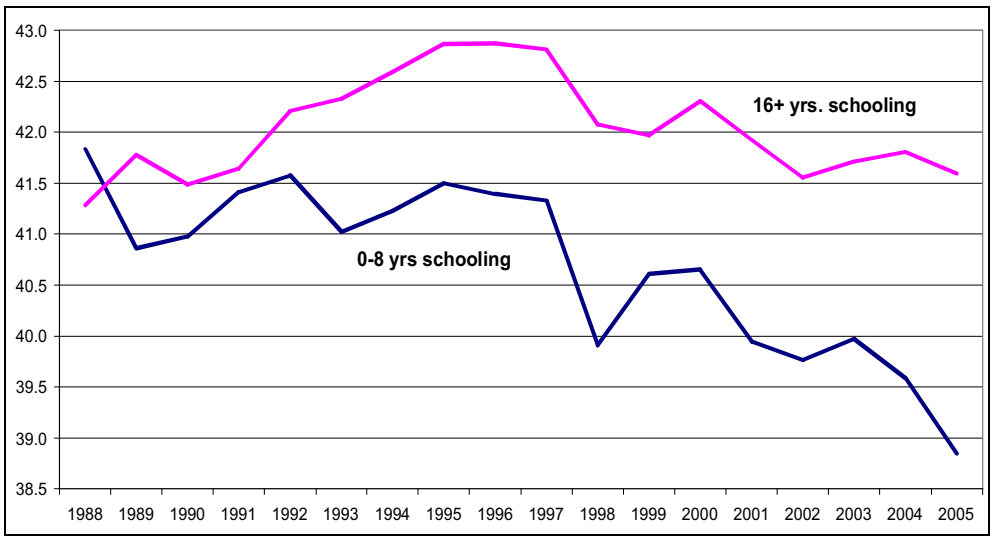
Figure 1
Ratio of the Effect of Changes in Hours Worked and Changes in Employment on Labor Input[1]



[1]The percentage change in labor input at time t, $\tilde{\Delta}L_t$ is approximately the sum of the percentage change in the number of employee $\tilde{\Delta}N_t$ and the percentage change in average working hours per employee - $\tilde{\Delta}H_t$, $\tilde{\Delta}L_t = \tilde{\Delta}N_t + \tilde{\Delta}H_t$. Here we present the absolute value of the ratio $\tilde{\Delta}H_t / \tilde{\Delta}N_t$.

[2] For presentation clarity, the value of the relation in 1998 and 2001, as positioned in the graph, is 1, even though the changes in working hours were actually much greater than those in employment.

Figure 2
Average Weekly Working Hours of Employees with Various Levels of Schooling



of tax and social-benefit reforms (which influence the effective tax rate) on labor supply. Differences among socioeconomic groups in the elasticity of hours to wages and GDP may change the income distribution at times of economic expansion; they may also affect the efficacy of policy measures that seek to influence income distribution via the labor market.

Many studies have noted the importance of changes in working hours in explaining labor-market processes.[3] Analyses of the effect on the labor market of various policy measures and macroeconomic developments show that much of the response to these changes, especially in the short term, takes place via the adjustment of working hours (the "intensive margin"). Usually, studies that tested the elasticity of women's working hours found larger elasticities.[4] Brown (1999) indicates that the effect of policy measures via the working hours is greater than the effect on the number of persons employed, and Stewart & Swaffield (2006) found that much of the effect of the introduction of a minimum wage in the U.K. manifested itself in the working hours of low-wage workers. Flug & Kasir (2006) found that changes in the terms of single-mother benefits in Israel in the mid-1990s had a perceptible effect on their working hours.

Analysis of working hours is also important in measuring the effect of policy steps on the total income and employment of specific groups in the labor market. In a study on young adults in the U.S., Couch & Wittenberg (2001) showed that changes in working hours accounted for 10–30 percent of the total effect of the policy measures that were applied to this group. Disney & Smith (2002) found that changes in the formula used to

[3] For a survey of research on the topic, see Blundell & MaCurdy (1999), Killingsworth & Heckman (1986), and Pencavel (1986).

[4] See, for example, Keane & Moffit (1995) and Van Soest et al. (1990).

offset pension-benefit payments in the U.K. against wage increases had a strong effect on men's working hours and, to a lesser extent, on women's working hours in the relevant age group. Also, Neumark et al. (2004), studying the effect of the minimum wage on income of workers from weak population segments, found that changes in working hours occasioned by policy changes played an important role in the change in these workers' total income. In studies on the effect of British and American employment-subsidy programs, Blundell et al. (2000) and Eissa & Hoynes (2004) found, respectively, that reducing the working hours of certain employee groups (mainly married women from low-income families) offset nearly all of the positive labor supply effect that the programs had attained by increasing the number of persons employed.

An ordinary inspection of Israeli labor-force surveys allows us to examine total labor supply and its components: the number of workers and their average working hours. However, it does not allow direct identification of the workers who changed their working hours, nor to determine whether the change in average hours solely reflects differences in working hours between those who enter and exit the market and those steadily employed.[5] Additionally, such an inspection cannot determine whether workers who change their working hours have different characteristics than those who do not. The last-mentioned question is crucial in understanding the implications of macroeconomic changes on the distribution of income and poverty. Furthermore, beyond the lack of data, the use of cross-sectional data creates problems in identifying behavioral effects because such studies actually identify the workers who tend to put in more hours and not behavioral processes (Kalwij & Gregory, 2000). This is because in such studies it is difficult to treat unobserved worker characteristics that affect working hours and may be correlated with the wage (Friedberg, 2000); consequently, they may elicit biased estimators. Imai and Keane (2004) demonstrate this by showing that estimates of working-hours elasticity to wages in cross-section studies are downward-biased because they fail to account for human-capital acquisition as a factor in the return to labor, especially among young workers.

To examine the change in specific employees' working hours, we used the repeat-interviews component of the Israel Central Bureau of Statistics' labor-force surveys (see Section 2 below). Utilizing this database, we examined the response of working hours to changes in wages and GDP, controlling for changes in employees' personal circumstances during the same period and testing whether people with different characteristics respond differently to changes in these variables. Previous studies found that the hourly wages of workers from weak population segments and the employment rate of individuals from low-income families are less responsive to changes in GDP than those of greater earning ability or family income (Brender & Strawczynski, 2006; Israel Democracy Institute, 2006). The current study allows us to check whether the response of working hours to GDP growth offsets some of the dynamic favoring the widening of disparities that these findings pointed out, or widens them; this would depend on whether the intensity of the response of working hours to wages is greater in weak population groups and offsets the steeper increase in the hourly wages of members of strong groups (see, for example, the trajectory of schooling

[5] Brender & Strawczynski (2006) show that both those entering employment and those exiting it work fewer hours than the steadily employed.

coefficients in Table 5 below) or vice versa.[6]

The labor-force surveys (LFS), the only source providing repeat observations of the same workers, furnish no data on the individual worker's wage. To surmount this difficulty, we follow Brender, Peled-Levi, & Kasir (2002) in using estimates of the potential wage per working hour (see Section 3 below). These estimates also help us to address another technical problem of studies on the relation between working hours and changes in wages: the possibility of a reporting error in the working-hours data. Since the hourly wage is calculated by dividing total income by working hours, similar to other Income Surveys based studies in Israel and elsewhere, the existence of measurement/reporting errors skews (negatively) the measured relation between wage coefficients and hours.[7] The use of wage estimates prevents this bias of the wage variable, which has been found to be important mainly in data on wages of managerial and white-collar workers (Duncan & Hill, 1985).

Working hours may also be affected by changes in the incomes of workers and their families (as distinct from the income effect included in the wage elasticity). In cross-sectional studies on the Israeli economy, a positive correlation between income and employment was typically found, in contrast to theoretical expectations, due to the correlation between traits of workers from high-income families and factors that affect the extent of the job that one holds.[8] Studies in other countries also had difficulties in finding income elasticities consistent with theory, and those who did found them to be small.[9] In the current study, we are able to test the short-term income elasticity differently from previous studies in Israel by measuring the relation between the **change** in an individual's working hours and **changes** in his/her spouse's wage.

The rest of the article is organized as follows: Section 2 presents the database used in the study and describes the method used to identify repeat observations and its implications for the sample. Section 3 describes the calculation of the potential wages and Section 4 presents the estimation method and the variables expected to affect working hours. Section 5 shows the estimation results and Section 6 discusses the effects of changes in GDP and unemployment on working hours. Finally, Section 7 summarizes and concludes.

2. SAMPLE AND IDENTIFICATION OF REPEAT OBSERVATIONS

To track changes in working hours and worker characteristics, we use a merged file of the Israeli Labor-Force Surveys (LFS) for 1994–2005. The surveys are based on a sampling of dwellings, with each sampled dwelling enumerated four times (two consecutive quarters, two quarters "off," and then two additional quarters). This is supposed to elicit four

[6] Data constraints limit the study to short-term elasticities. Long-term elasticities may be greater due to human-capital accumulation occasioned by experience (Keane & Wolpin, 1997), as found, for example, by Eckstein & Cohen (2001) in Israel.

[7] The negative bias is caused by the presence of working hours in the denominator of the calculated hourly wage. Hence, any measurement/reporting error of hours will affect the hourly wage in the opposite direction.

[8] See, for example, Brender, Peled-Levi, & Kasir (2002) and Flug and Kasir (2001).

[9] See, for example, Imbens, Rubin, & Sacerdote (2001) and Holtz-Eakin, Joulfaian, & Rosen (1993).

observations for each person in each dwelling. People who moved out of a sampled dwelling, who moved to a sampled dwelling, or who cannot be identified due to deficiencies in the data have fewer observations.

To identify repeat observations of the same person in the merged survey, we devised for each observation an identifying variable including the location of the dwelling, an ID number for the household, the sampling year, the first quarter in which the person was included in the sample, type of observation, an ID number for the person in the household, and gender. Since these variables are constant for each person, they were chained in order to create a personal identifying variable. The files were merged on a triennial basis—because the time between an individual's first and last enumeration can span three calendar years at the most—and a code denoting the year of the first interview of the observation was added to the identifying variable. Once identified, logical checks were performed to ensure that the individual's variables showed no illogical changes (e.g., a decline in age or level of schooling).

The basic sample comprises 396,193 observations representing 125,069 individuals who worked during the first period and were relevant for inclusion in the study (men aged 23–75 and women aged 22–70). Since we wish to monitor changes over time, we are interested only in workers whom we observed at least a year after their first enumeration. The estimation method, as stated, samples the dwelling and monitors the individuals inhabiting it. If tenants move into or out of a monitored dwelling, the sample will have data on them for one period only. This reduces the sample by 31,038 individuals, distributed over the years as shown in Table 1. The table shows that 75 percent of individuals in the sample are identified in two periods, as we define them, so their data may be used. The observation-loss rate is stable and diminishes slightly over the years except for 1994, when it was much higher due to the restructuring of the survey in 1995. Table 2 shows the distribution of individuals who lacked repeat observations relative to those who "survived," sorted by population groups. This comparison reveals that the survival rate is low among the young

Table 1
Distribution of Workers Included in Sample, by Years

	Total (1)	Workers identified in the first period only (2)	Workers identified in two periods (3)	Pct. of survivors in sample (3)/(1) (%)
1994	12,166	5,694	6,472	53.2
1995	12,402	2,750	9,652	77.8
1996	11,527	2,756	8,771	76.1
1997	11,226	2,621	8,605	76.7
1998	11,273	2,350	8,923	79.2
1999	11,287	2,384	8,903	78.9
2000	11,125	3,168	7,957	71.5
2001	11,249	2,355	8,894	79.1
2002	11,138	2,269	8,869	79.6
2003	10,788	2,216	8,572	79.5
2004	10,888	2,475	8,413	77.3
Total	**125,069**	**31,038**	**94,031**	**75.2**

(aged 22–30) and among recent immigrants and high among the ultra-Orthodox, mothers of three or more children, inhabitants of development towns, and Arabs. The differences in these groups' identification trace to the characteristic of the sampling method that does not allow the identification of people who changed domicile; the probability of moving is high among the young and among immigrants. By and large, the comparison shows that there are no major differences between the "survivors" and the lost observations. Nevertheless, the empirical work should account for the possibility that the estimated relations are different among the young and the immigrants as compared to the rest of the population. The average working hours of survivors and dropped observations are also quite similar, whereas the average wage gap between these two groups corresponds to their different composition since the wages of young employees and immigrants—whose share among the survivors is smaller—is lower.

Table 2
Comparison of Characteristics of "Surviving" and Disqualified Observations (percent)

	Workers remaining in sample	Workers identified only in the first period	Total
Total	100.0	100.0	100.0
Men	53.8	53.1	53.6
Women	46.2	46.9	46.4
Age 22-25	7.4	11.6	8.5
Age 26-30	12.4	20.1	14.3
Age 31-40	27.2	27.5	27.3
Age 41-50	29.3	23.3	27.9
Age 51-60	17.9	12.6	16.6
Age 61-65	3.9	3.0	3.7
Age 66-75	1.8	1.9	1.8
0-8 years of schooling	8.8	6.0	8.1
9-10 years of schooling	8.7	7.3	8.4
11-12 years of schooling	34.0	32.9	33.7
13-15 years of schooling	24.9	30.2	26.2
16+ years of schooling	23.6	23.5	23.6
Born in Israel	59.1	65.7	60.7
Arabs	7.4	4.1	6.6
Immigrants, up to 10 yrs	12.7	15.4	13.4
Ultra-Orthodox	3.1	1.5	2.7
Married	78.1	66.9	75.3
Unmarried	21.9	33.1	24.7
Single-parent	3.6	4.0	3.7
Women w/o children	20.2	24.7	21.3
Mother of 1-2 children	18.7	16.8	18.2
Mother of 3+ children	7.3	5.4	6.9
Development-town resident	9.9	6.1	9.0
Avg. weekly working hours	41.8	42.6	42.0
Potential wage	5,914	5,446	5,798

Among those for whom we found repeat observations, 8 percent did not work in the second period (Table 3) and another 6 percent did not report their working-hours in that period. Ultimately, 80,865 workers, 65 percent of the original observations, survived in the sample. This survival rate is quite high compared with samples such as the British NES, in which only 47 percent of observations permitted year-on-year surveillance (Kalwij & Gregory, 2000), and is similar to those reported by Startton (1996), Bound and Kruger (1991) and Card (1991) who used similar techniques on US surveys.

Table 3
Sifting of Observations for Final Sample

	Workers
Sample	125,069
Not identified in second period	*31,038*
Identified	94,031
Thereof: not working in second period	*7,620*
Working in second period	86,411
Thereof: no reportage on wage or hours in second period	*5,546*
Data about second period provided	80,865
Data for the study	**80,865**

3. ESTIMATION OF THE POTENTIAL WAGE

Since the LFS provide no data on individuals' income, direct reportage by workers about their wages and changes in them cannot be used for the elasticity estimates. As stated above, the potential problems in calculating the hourly wage also raise concerns about the possibility that the estimates of the relation between working hours and the hourly wage, based on directed reported wages, may be biased. Hence, we estimated hourly-wage equations on the basis of income surveys in order to instrument the wages.[10] These surveys present data on gross wage income (the "Average Income from Wages" variable) and weekly working hours (the variable used is "usual" weekly hours of paid labor) which were used to calculate the hourly wage, the dependent variable in the wage equation. To obtain a consistent and unbiased estimator for this study, we omitted observations of workers who are irrelevant to the study (women outside the 22–70 age cohort and men outside the 23–75 cohort) and outliers (workers whose hourly wage was less than half the minimum wage or greater than the average wage by three standard deviations). The hourly-wage equations were estimated separately for women and for men for each year in the income survey and the respective coefficients were used to predict the hourly wage for the observations in the LFS for that year. The equation included the individuals' demographic characteristics, most

[10] The income surveys are a subgroup of the LFS. In the fourth enumeration of the LFS, subjects are asked about their income and the data they provide constitute the income survey, in which, accordingly, each household appears once. Since there is no direct link between the LFS and the income survey, individuals' income as reported in the income survey cannot be reconciled with the individuals' fourth-enumeration data in the LFS.

of which were found to be significant in all years.[11] Table 4 describes the average-wage gap between the forecast obtained in the labor-force surveys and the actual wage in the income survey for the total sample and by population groups. (A positive value indicates that the forecast surpassed the original wage.) The gap between wage and forecast is in magnitudes of several percentage points for most groups, except for Arabs and immigrants in the 2002–2005 period.

Table 4
Disparity between the Wage Reported in the Income Survey and Forecast Wage in the LFS[1]
(percent)

	1994-1997	1998-2001	2002-2005
Total	3.5	1.2	0.1
Men	2.6	0.4	-0.9
Women	4.4	2.1	1.2
0-8 yrs schooling	3.9	1.6	0.9
9-10 yrs schooling	7.1	1.8	0.4
11-12 yrs schooling	3.1	1.0	-0.3
13-15 yrs schooling	6.4	2.0	-0.1
16+ yrs schooling	4.5	1.5	0.2
Arabs	-2.5	-5.7	-5.5
Immigrants	-2.7	3.1	4.8
Age 22-30	5.9	0.9	-1.9
Age 31-40	5.1	2.8	1.0
Age 41-50	2.7	0.9	0.8
Age 51-60	3.2	1.8	-0.2
Age 61-70	1.5	1.5	1.0

[1] The forecast wage in the LFS less than that reported in the Income Survey.

Tables 5.1 and 5.2 report the average long-term coefficients of the wage equations for men and women, respectively. The return to a year of experience, represented by the coefficient of the age variable, is positive but declines with age—an effect reflected in the negative coefficient of the squared age, which is also included in the equation. The age at which the return to an additional year of labor turns negative - 50–52 - is stable throughout the sample period and similar for men and for women. Coefficients that increased over time are those of persons with 16+ years of schooling, which rose by 5 percentage points of average wage among women and by 10 percentage points among men.[12] The wage coefficient of public-sector employees was sizable (positive) and significant mainly in the mid-1990s, when a number of generous wage accords were concluded; afterwards, however, it decreased and lost its statistical significance.

[11] The variables used in the estimation are detailed in tables 5.1 and 5.2. All the variables appear both in the LFS and the income survey and the wage estimate was calculated by multiplying the regression coefficients, estimated in the income surveys by the values of the variables reported in the LFS.

[12] The calculation is conducted by dividing the coefficient by the average wage, reported at the bottom of the table.

Table 5.1
Mean Wage Equation Coefficients - Men[1]

Variable[2]	1994-1997	1998-2001	2002-2005
Age	1.79	2.38	2.44
Age squared	-0.02	-0.02	-0.02
Arab-age interaction	-0.20	-0.46	-0.45
Arab-age squared interaction	0.00	0.00	0.01
Works in public sector	2.56	1.03	1.68
Father born in Asia/Africa	-2.76	-3.94	-3.01
Ultra-Orthodox	-12.50	-20.56	-21.36
Married	1.99	3.90	5.77
Recent immigrant	-15.38	-20.68	-21.50
Long-tenured immigrant	-3.51	-5.37	-10.56
Spouse's schooling (yrs)	1.05	1.41	1.42
0-8 yrs schooling	-5.23	-5.86	-6.50
9-10 yrs schooling	-2.31	-3.60	-3.77
13-15 yrs schooling	5.34	8.62	8.95
16+ yrs schooling	10.79	18.97	22.26
Constant	-18.50	-24.41	-27.06
Observations	3,282	6,294	6,621
R sq Adjusted.	0.34	0.34	0.30
Avg. hourly wage in period	***27.37***	***40.53***	***45.33***

[1] The coefficients are expressed in NIS (2005 prices) per unit of the variable.
[2] The equations also include dummy variables for district and for rooms per person.

Table 5.2
Mean Wage Equation Coefficients - Women[1]

Variable[2]	1994-1997	1998-2001	2002-2005
Age	0.88	1.33	1.96
Arab	-2.49	-6.61	-4.08
Works in public sector	2.34	0.95	0.53
Father born in Asia/Africa	-1.13	-2.78	-1.86
Number of children	0.57	1.01	1.51
Recent immigrant	-9.64	-14.64	-15.22
Long-tenured immigrant	-1.32	-3.06	-6.75
Spouse's schooling (yrs)	0.80	1.27	1.62
Age squared	-0.01	-0.01	-0.02
0-8 yrs schooling	-5.26	-5.67	-3.70
9-10 yrs schooling	-2.55	-3.39	-2.70
13-15 yrs schooling	4.73	6.78	7.32
16+ yrs schooling	9.29	15.59	17.62
Constant	-5.33	-9.72	-23.71
Observations	3,247	6,067	6,308
R sq Adjusted.	0.32	0.30	0.26
Avg. hourly wage in period	***22.25***	***33.34***	***38.24***

[1] The coefficients are expressed in NIS (2005 prices) per unit of the variable.
[2] The equations also include dummy variables for district and for rooms per person.

Arab workers had lower hourly wages than Jews throughout the period, controlling for other worker characteristics. Among women, the disparity was 11 percent of the average wage; among men it was 15 percent in most age brackets and narrowed only among the oldest workers. The wages of ultra-Orthodox men were substantially lower than those of non-religious ones, whereas there was hardly any gap between women from ultra-Orthodox families and non-religious women. Immigrants' wages were substantially lower than those of veteran residents, but more than half of difference disappeared after ten years of residency in Israel, as may be seen in the differences between the coefficients of the "recent-immigrant" and the "longtime-immigrant" (more than ten years in Israel) variables in 2002–2005.

Based on the hourly gross-wage estimates we calculated the worker's marginal hourly net wage. To perform this calculation, we multiplied the average hourly-wage estimate by the number of hours reported in the worker's first observation and applied the relevant tax function (income tax, social insurance contributions, and health tax) for that year to the product obtained. In this calculation we used the applicable tax credits to each individual including those for children, non-working spouses and immigrants. Based on this data we found the individual's **marginal** tax rate and calculated the net wage for the **marginal** hour. We repeated the computation in the worker's second observation on the basis of working hours in the first period (to abstract from potential effects of the change in wages on the hours) and the estimated wage function for the second period. We then calculated the intertemporal change in wage on the basis of the intertemporal change in net hourly wage, deflated by the Consumer Price Index.

4. ESTIMATION OF THE CHANGE-IN-HOURS EQUATIONS

The correlation between the *change in working hours* and the *change in the potential hourly wage* is estimated on the basis of the following model:

$$\ln\left(\frac{h_{t+1}}{h_t}\right) = \beta_0 + \beta_1 w_t^d + \Phi \cdot H + \beta_2 \left[w_t^d z_t\right] + \beta_3 z_t + \beta_4 D_t + \beta_5 h_t + \varepsilon_t$$

Where:

h_t — working hours in period t

$w_t^d = \ln\left(\frac{w_{t+1}}{w_t}\right)$ — rate of change in the potential hourly net wage.

$\Phi * H$ – a vector which includes the expression $\phi_1 h_t w_t^d + \phi_2 h_t^2 w_t^d$

z_t - a vector of demographic and occupational variables (marital status, schooling, age, children's age, occupation, income level, spouse's employment, sector).

$\left[w_t^d z_t\right]$ – interaction between change in wage and demographic variables.

D_t _ changes in worker's demographic characteristics (change in marital status, onset and completion of studies, reaching pension age, entering and leaving the public sector).

Due to the choice of a logarithmic function for the dependent variable, the regression coefficients are an approximation of the percent change in working hours. The logarithmic function also expresses a model that corresponds to two-period panel data because a first-differences model—such as the logarithmic difference in the current model—parallels a two-period fixed-effects model (Woolridge, 2001).[13]

Given the differences between men's and women's responses to various labor-market developments, as observed in previous studies in Israel and elsewhere, we estimate the equations separately for the two sexes. Furthermore, to prevent extreme values from affecting the equation, we exclude all observations that elicit an estimated wage change that surpasses 30 percent in absolute terms (3 percent of the sample), much as in Brender & Strawczynski.[14] Since the analysis of the observations loss in Section 2 identified the potential of under-representation of young people and immigrants in the sample, and since we treat each person in the sample as a discrete observation and do not use the weights that the Central Bureau of Statistics assigned (chiefly on the basis of geographic region, age group, and gender), we also test for the possibility of a different wage effect among these groups. This is done in order to ensure that the findings may be generalized to the employed persons' population at large.

a. Wage Changes

To examine how changes in workers' wages affect their working hours, we use the calculated (net) potential wage estimates and test whether real changes in the log wage correlate positively with change in working hours (also expressed in logs). The wage-change estimates reflect two components: changes in personal characteristics and changes in the macroeconomic environment and tax rates that alter the "price" of the individual's characteristics. These are exogenous to the worker and represent the demand side.[15] This effect is reflected in coefficient β_1. Since one cannot rule out ex-ante the possibility that the wage effect acts differently on different groups of workers, we test the effect of interaction between the wage and various worker attributes so that the wage effect for workers who have these attributes is $\beta_1 + \beta_2 \cdot z_i$.[16] However, changes in worker characteristics may also affect working hours irrespective of wage. For example, students completing their studies

[13] $\ln\left(\frac{h_{t+1}}{h_t}\right) = \ln(h_{t+1}) - \ln(h_t) \qquad \ln\left(\frac{h_{t+1}}{h_t}\right) = \ln(1+\Delta h) \approx \Delta h$

[14] The inclusion of these observations hardly affected the wage-equations coefficients of men. In the women's equations, the inclusion of the observations reduced the estimated wage-elasticity by one-third but left it statistically significant. The other coefficients in the equations were not qualitatively affected by the change in the sample.

[15] Since we deal with the shot-run, it is unlikely that employees' demographic characteristics are affected by wages.

[16] Heckman (1973) claims that on-the-job learning is an important element in the return to labor for young people and less so for older ones. For this reason, wages are a smaller component of the return to labor for the former. If his argument is correct then working-hours elasticity to monetary wage will be smaller among the young. To test this, we include in the equation an interaction between age and wage changes, but this variable is significant only for Arab men.

successfully, free up time that allows them to work more. Therefore, to test the effect of wages beyond the effect of change in personal attributes, we test the effect of changes in each of the attributes included in the wage equation and omit only those that have no significant effect on change in working hours. [17]

The estimation of the relationship between wages and working hours raises the question whether wage changes are exogenous to the employee, facilitating an identification of the supply response to these changes, or whether they reflect changes in the supply of working hours which affect wages (in the opposite direction) hence preventing identification of the supply curve. The analysis in the current study was designed in a way that will handle this problem both at the aggregate level and for sub-groups of employees. First, the wages estimated at the initial stage are not based on the actual wage but on a projection derived from a wage equation estimated for all employees. Changes in the behavior of an individual wishing to expand his job, and willing to cut his hourly wage to do that, will not be reflected in his/her "potential" wage which is derived from the market for all the employees with similar attributes. However, the potential wage estimated in this way and its annual change reflects the equilibrium wage, which is affected by changes in demand and in tax rates (the calculated wage is the net wage, as noted above) but also by changes in labor supply. Therefore, the equations for the change in working hours include control variables for the attributes that may be associated with a coordinated change in hours supply among groups of workers and by that affect their wages, so the remaining effect is of demand factors.[18] It is worth noting that from the point-of-view of changes in **working hours** changes in the number of employees, including those from specific groups are demand changes, because the dependent variable is the change in the working hours of those steadily employed.[19]

The supply elasticity estimated using this method is total price elasticity, composed of income and substitution elasticities. As a result of the income effect, however, the effect of wage changes on working hours may vary commensurate with the number of hours worked during the first period. This is because the effect of a given change in the hourly wage on a worker's total income depends directly on the extent of his/her job. Consequently, the (negative) income effect will be greater the more hours he/she works in the first period. Furthermore, the change in hours may also be a feature of workers' unobserved characteristics, different divisions of labor in their households, and effects related to the characteristics of the job. Workers who wish to increase their employment and already

[17] Potential effects of changes in demand are discussed below.

[18] Consider a hypothetical example in which immigrants change their behavior and increase their hours supply along with their tenure in Israel. In such a case the change in behavior may result in a reduced wage so the equation will point to a negative correlation between changes in wages and in working hours, which does not reflect the supply elasticity. However, if a control for being an immigrant is added to the equation, the effect of the behavioral change on working hours will be attributed to the control variable and not to the change in wages. A similar analysis can be presented for a case in which the hours' supply of youngsters is diminished by the expansion of the supply of higher-education institutions.

[19] Because the change in working hours is tested for continuing employees, the effect of entries and exists from the labor market by other employees (even if it reflects supply changes) is exogenous for the continuing employees and therefore the wage changes resulting from these transitions affect the demand the continuing employees are facing.

work full-time, or near full-time, may, for example, move up to the threshold beyond which the employer must pay them at an overtime rate; if the employer wishes to skirt this obligation, such workers will find it hard to expand their job unless they take on an additional job with another employer. Other workers may be employed at jobs that remunerate them on a global basis, leaving them wholly unpaid for overtime. (As stated, information whether workers in more than full-time jobs are paid by the hour or globally is not available.) To test the possibility of a different response of extent of job to wage changes, we include in the equations the expression $\Phi * H$ which contains interactions of the change in the wage with the number of hours worked in the first period and the number of hours squared. (Since there is no reason to assume ab initio that this relation is linear.) We also include the number of hours worked in the first period.[20]

Another question that comes into play in understanding the potential effects of policy changes is whether major changes in wages affect working hours more than small ones. In many cases (particularly where female workers are concerned), in order to adjust their working hours workers must change their life routines and those of their families, must change their transportation arrangements, and, perhaps, arrange childcare. Due to fixed costs of this kind, workers may not wish to change their hours for small changes in the wage but would be inclined to do so if the changes are large enough. To test this, we added a variable composed of the rate of wage change multiplied by a binary variable for changes larger than 10 percent in the hourly wage between the periods. Then we examined whether this variable illuminates a significant difference in the response to small changes versus large ones.

A characteristic that may affect the relation between wage changes and changes in working hours is the worker's wage level. This variable may reflect worker attributes that are not directly observable (e.g., motivation) and that may lead to different responses to wage changes at different income levels. Since the sample spans a relatively lengthy period in which appreciable changes in real wages occurred, we calculated for each year the distribution of the workers' wages and divided the population (men and women separately) into income quintiles. We multiply the variable that defines each worker's wage quintile in the first-sample year by the change in wage and test for differences in the response to wage changes at different income levels.

Another factor that may affect the response to wage changes is family income. The survey provides us only with data on changes in the (estimated) spouse's wage; data on other family income are unavailable. Even if the changes in this variable are positively correlated with changes in a worker's wage, they have a dampening effect on his/her hours supply due to the income effect and the way the household arranges its division of labor. Also, the worker's share in total family labor income may affect elasticity. The family's main breadwinners may display greater elasticity because they do only a limited share of the housework; in such a case, they may tailor their working hours to opportunities in the

[20] The estimation of the equations without this variable, or the replacement of this variable with the number of the employee's working hours in an observation that is not one of the two that we use to calculate the dependent variable (following Blank's [1994, 1998] approach), does not qualitatively change the results of the men's equation and reduces the estimated working-hour elasticity to wage in the women's equation at hour-intensive jobs.

labor market. In contrast, the elasticity of those who account for a relatively small share of family income—and therefore are in charge of the household—would be limited.[21] To test the effect of these factors, we add to the equations the rate of change in the spouse's wage, an interaction between this variable and the spouse's share in family income (adjusted to working hours in the first period), and an interaction between wage change and the worker's share in family income (in the first period).

b. Changes in personal characteristics

The changes in workers' supply of hours depend on changes that occur in their personal circumstances. Family income is an important factor of this kind, but additional developments in workers' life circumstances may affect the quantity of working hours they supply. Since students usually work fewer hours than non-students, we would expect the onset and completion of studies to reduce and increase working hours, respectively, beyond the effect of changes in the potential wage and GDP. We would expect childbirth to reduce the mother's working hours even after she returns to work, and changes in marital status, such as marriage or divorce, may also affect how much of a job one holds. Furthermore, reaching the retirement age is usually associated with cutting back on one's working hours, if one continues to work at all.

c. Employee characteristics

Changes in personal attributes aside, certain characteristics may predispose workers who have them to change their working hours, relative to those who do not. Such differences may reflect unobserved personal characteristics along with variance in the return to human capital that the individual expects to acquire on the job. Young people, for example, are likely to increase their working hours more than older workers who have already settled into their jobs, whereas the oldest workers, especially those past retirement age, will cut back on their working hours because the human capital they may acquire is worth less to them. Family needs and social norms may induce married men and, in particular, fathers of children to expand their working hours more than other men and may prompt married women to increase them less. Differences may also exist among men at different levels of schooling and between the ultra-Orthodox and the non-religious. Given the circumstances of the Israeli labor market during the research period, it is also probable that recent immigrants would expand their jobs differently than nonimmigrants as they move up the job ladder. Differentiation among workers by occupation is also possible.

[21] In this study we test only the short-term elasticity — a year to a year and a half.

5. MAIN FINDINGS

a. Elasticity of working hours to wages

Men: Table 6 reports the basic equations estimated for changes in Men's working hours. Equation 1 includes only the wage variables and the changes in the personal characteristics of each individual. In Equation 2 we add controls for demographic attributes and Equation 3 also contains interactions of the wage change with the demographic characteristics and other variables. The equations show that the wage elasticity of men's working hours depends on the individual's demographic attributes and on the composition of family income, as reflected in the significance of the interaction variables between the wage change and the demographic variables and the employee's share in family income (Equation 3). Nevertheless, most men fall into the range of hours and attributes in which the wage elasticity is zero.[22] In the base case of a sole (including single) breadwinner, born in Israel, whose family income per standard person is greater than the lowest quintile, and who has fewer than sixteen years of schooling, is not a student, and works in the business sector, the total price elasticity of the wage is positive at jobs of up to 44 hours per week. (28 percent of men in this group work fewer than 44 hours per week.) However, the elasticity is low and declines as the extent of the job held increases, probably due to the income effect and the aforementioned constraints on increasing one's hours. For example, those holding jobs entailing a 35-hour work week are expected to add 0.6 hours in response to a 10 percent change in their wage, while those putting in 40 hours will add only 0.24 hours (Figure 3). While the elasticities for men in very part-time jobs are greater, they are relevant only for a relatively small group of workers because more than 93 percent of men work at least 32 hours per week. If we postulate that the interaction effect between change in wage and extent-of-job change only reflects the income effect, then the elasticity of working hours to income, derived from the change in total price elasticity of working hours, is (–0.02)—similar to those found in studies in other countries (Alesina et al., 2005). However, as stated, the data do not allow us to separate the income effect from other constraints to change in working hours.

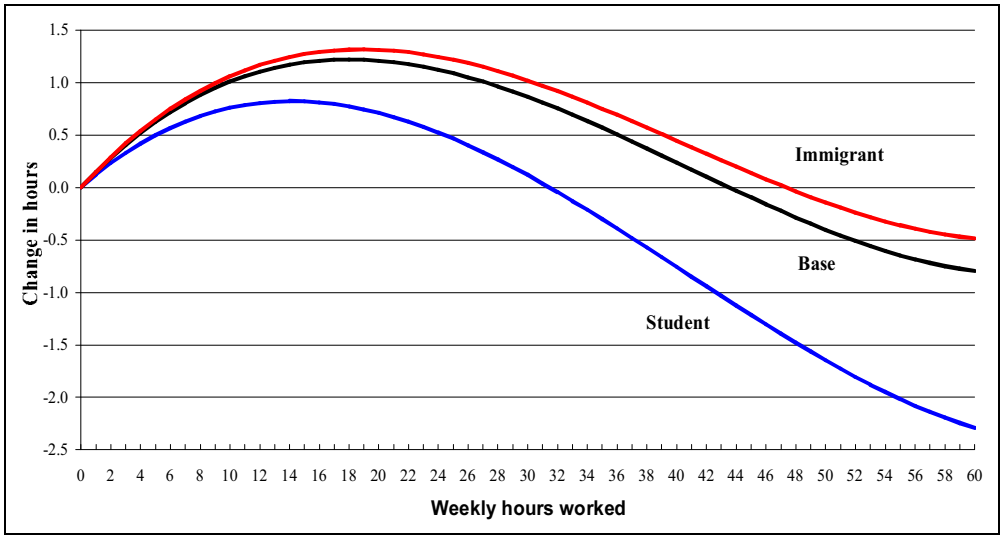
[22] The wage elasticity of working-hours varies among workers with different attributes as well as between workers employed a different number of hours in the first period. The projected change in hours due to a wage change was calculated in the following way:
$h_{t+1} - h_t = w_t^d \left(\hat{\beta}_1 + \hat{\phi}_1 h_t + \hat{\phi}_2 h_t^2 + \beta_2 * Z_t\right) \cdot h_t$. Since the elasticity depends on the number of working hours and on employee characteristics we present it in chart form. Charts 3, 4 and 5 show the case where $w_t^d = 0.1$.

Table 6
Elasticity of Hours to Wage Changes Equations - Men[1]

Explanatory Variables	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value
Wage variables	(1)		(2)		(3)	
Change in marginal wage (%)	1.183	0.000	1.149	0.000	1.127	0.000
Working hours in first period * change in wage	-0.049	0.000	-0.050	0.000	-0.054	0.000
Working hours squared in first period * change in wage	0.0004	0.000	0.0004	0.000	0.0004	0.000
Change in personal indicators						
Reached pension age	-0.112	0.000	-0.043	0.002	-0.042	0.002
Became student	-0.115	0.000	-0.125	0.000	-0.119	0.000
Ceased to be student	0.102	0.000	0.153	0.000	0.141	0.000
Joined public sector	-0.085	0.000	-0.090	0.000	-0.093	0.000
Left public sector	0.015	0.027	0.055	0.000	0.054	0.000
Spouse became student	0.041	0.000	0.021	0.024	0.020	0.030
Got married	0.034	0.015	0.051	0.000	0.049	0.001
Had child	0.007	0.099	-0.014	0.000	-0.013	0.001
Demographic variables						
Age			0.008	0.000	0.008	0.000
Age squared			0.000	0.000	0.000	0.000
Pension age			-0.090	0.000	-0.091	0.000
Divorced			-0.015	0.063	-0.016	0.042
Single			-0.042	0.000	-0.042	0.000
Parent			0.008	0.037	0.007	0.049
Number of children			-0.005	0.000	-0.005	0.000
0-8 yrs schooling			-0.022	0.000	-0.023	0.000
16+ yrs schooling			0.012	0.002	0.014	0.000
Public sector			-0.050	0.000	-0.055	0.000
Teacher			-0.056	0.000	-0.060	0.000
Student			-0.071	0.000	-0.075	0.000
Arab			-0.069	0.000	0.001	0.000
Arab * age			0.001	0.057	-0.015	0.023
Recent immigrant			-0.017	0.000	0.000	0.000
Recent immigrant * age			0.000	0.085	-0.059	0.005
Ultra-Orthodox			-0.058	0.000	0.011	0.000
Father born in Europe/America			0.008	0.021	0.011	0.003
Family income (per standard person) in lowest quintile			0.038	0.000	0.038	0.000
Family income (per standard person) in highest quintile			0.016	0.000	0.018	0.000
Worker's share in family's wage income			-0.033	0.000	-0.033	0.000
Interactions of change in wage with miscellaneous variables						
Worker's share in family income					0.337	0.000
Number of breadwinners in household					0.036	0.011
Changes >10%					-0.177	0.000
16+ yrs schooling					-0.183	0.000
Non-academic higher studies					-0.092	0.005
Student					-0.249	0.001
Became student					-0.242	0.002
Ceased to be student					0.242	0.016
Arab					0.375	0.002
Arab * age					-0.006	0.038
Recent immigrant					0.234	0.000
Ultra-Orthodox					0.244	0.000
Works in public sector					-0.083	0.004
Family income (per standard person) in lowest quintile					-0.093	0.013
Father born in Europe/America					-0.182	0.000
Working hours in first period	-0.009	0.000	-0.011	0.000	-0.011	0.000
Intercept	0.438	0.000	0.442	0.000	0.438	0.000
Observations	42,105		42,105		42,105	
R-squared	0.197		0.231		0.236	
Adj. R-squared	0.197		0.231		0.237	

[1] Control variables for professions (liberal, high-tech, academic, managerial, white-collar, sales and unskilled) were also included in the equations.

Figure 3
Increase in Men's Working-Hours—Simulation of a 10 Percent Change in the Net Hourly Marginal Wage



The question whether the interaction effect between hours and wage change reflects mainly the income effect or, alternatively, constraints on changes in working hours is important in analyzing policy measures that affect wages, especially because the price elasticity calculated in our study falls to zero at jobs that verge on full-time. The elasticity is calculated on the assumption that the worker receives no special remuneration for overtime. However, if s/he receives the 50 percent premium that the law requires, then assuming that the interaction predominantly reflects the income effect, the response of working hours to wage changes should be positive—at magnitudes of 0.5–0.6 percent for each percent of premium over the basic wage—for those working over 40 weekly hours as well.[23] This is because the income effect has only a minor impact on the response to an overtime premium.[24] In contrast, if workers whose jobs entail more than 40 weekly hours cannot increase their hours when wage rises—especially at workplaces that pay an overtime premium—and the response of their working hours mostly reflects this constraint, then the elasticity will remain at zero even in response to changes in the marginal wage. In fact, working hours elasticity to wages in jobs of this scale reflects a weighted average of three groups: a) workers who cannot put in more hours in their current jobs (because their employers will not allow this); b) those who receive overtime remuneration and the employer allows them to expand their jobs; and c) those who receive global overtime remuneration; since these workers would gain nothing by expanding their jobs (at least in the short term), only the (negative) income effect applies to them. Absent information about

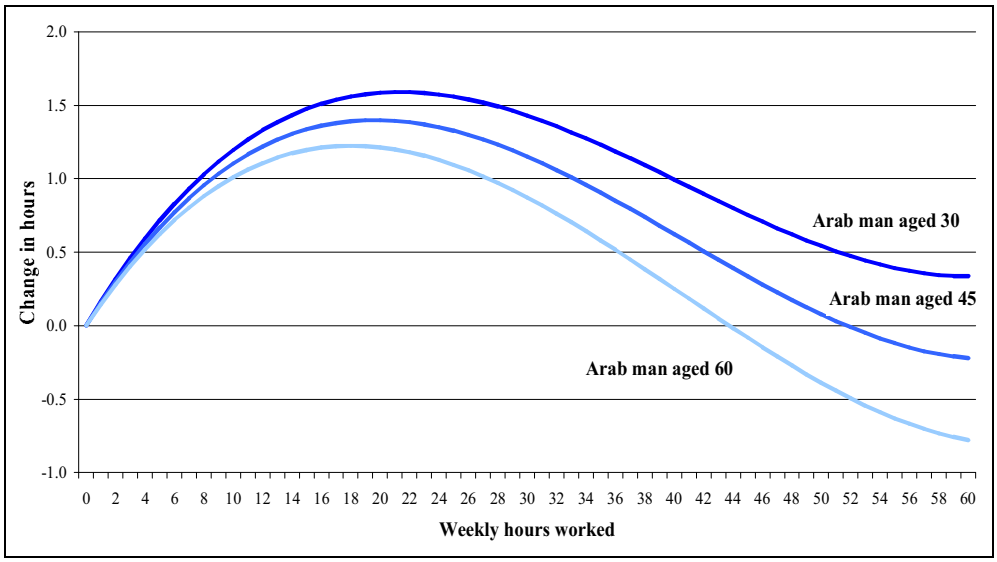
[23] By law, overtime pay is calculated on the basis of daily, not weekly, working hours. As stated, we have no information about whether specific workers are paid for the overtime that they actually put in.

[24] Since the premium is paid only for hours that exceed one's regular job, its effect resembles that of the wage paid for a small number of hours.

the distribution of workers among these groups, our ability to analyze the microeconomic factors behind the zero price elasticity at hours-intensive jobs is limited.

The estimation illuminates substantial differences in wage elasticity between population segments. Students respond less to wage changes; their hours' elasticity falls to zero at 32-hour jobs. However, a rather large percent of students fall into the range of positive elasticity because 30 percent of students work fewer than 30 hours per week. The working hours of Arabs, immigrants (up to 10 years tenure in Israel), and men from ultra-Orthodox households are more elastic to wage changes than those of other men. Among Arabs, however, the elasticity declines with age: for young Arab men (e.g., aged 30), the elasticity of working hours to wages is positive in jobs of all sizes, whereas for men aged 55 the elasticity closely resembles that of the rest of the population and at age 60 it is even lower (Figure 4). Furthermore, the elasticity is weaker among public-sector workers, offsprings of European and American fathers (including recent immigrants), and those who have 16+ years of schooling or non-academic higher education. We also found that when major wage changes of 10 percent per year or more occur, the relative response of working hours to the change does not intensify, evidently because most men hold full-time jobs in any case and find it difficult to significantly adjust their working hours in the short-term when a large wage change occurs.[25]

Figure 4
Increase in Arab Men's Working-Hours—Simulation of a 10 Percent Change in the Net Hourly Marginal Wage



[25] Separate testing of the elasticity to large wage changes, sorted by positive and negative changes, shows that the elasticity to positive changes is very close to zero whereas the elasticity to negative changes is negative (–0.3). Thus, the negative coefficient found in Equation 3 reflects mainly an increase in hours in the event of a steep decrease in the wage and not a decline in hours when wages rise.

The elasticity is also affected by marital status and spouse's employment. The household division of labor evidently allows men who are main breadwinners (whether married or single) to respond to wage changes by adjusting their hours. Conversely, the smaller a man's proportional contribution to his family's total labor income, the less elastic his hours are to wages. Married men whose wives work respond less to wage changes than sole or single breadwinners. In practice, about half the men are sole breadwinners, around one-third earn 60–80 percent of the household labor income, and the rest bring in about half of their families' income. The difference in wage elasticity between a sole breadwinner and a male who earns 70 percent of his family wage income is expressed in the number of weekly hours at which the elasticity falls to zero: 44 among the former, 40 among the latter.

Testing working hours' elasticity to wage changes by income levels of workers and their families, we find that the wage elasticities of men in the lowest income quintile (based on family labor income per standard person) are smaller than those of the rest of the population. However, since Arabs and workers from ultra-Orthodox families—two groups that exhibit large wage elasticity—are rather strongly represented in this quintile (30 percent), the total effect of wage changes on the extent of jobs held by bottom-quintile workers is slightly greater than that for the rest of the population.

Table 7 presents calculations of the total effect of wage changes on working hours. These calculations were performed on the basis of the 2004 LFS and Equation 3 in Table 6. We used the equation to estimate the expected change in hours when there is no change in wages (due to the effect of the other variables) and for a 5 percent wage change. The difference between the estimates is shown in the table. We find that the total effect of wage

Table 7
Change in Working Hours – Men [1]

Men	Change in working hours in response to a 5% wage change
Total	-0.272
Non-students	-0.254
Students	-0.517
Part-time workers (less than 40 hours/week)	0.310
Non-students working part-time	0.323
0-10 yrs schooling	0.064
11-12 yrs schooling	-0.083
13-15 yrs schooling	-0.279
16+ yrs schooling	-0.689
Not married	-0.046
Married -- sole breadwinners	-0.070
Married -- working spouse	-0.543
Arabs up to age 45	-0.019
Arabs aged 45+	0.245
Family income (per standard person) in lowest quintile	0.175
Family income (per standard person) in highest quintile	-0.732

[1] Calculated by means of a simulation based on Equation 3 in Table 6.

changes on men's working hours is very small except for men in the strongest groups—those with 16+ years of schooling and those in the highest income-distribution quintile—who reduce their supply of working hours considerably when their wages rise. In other words, the dominant effect among members of these groups is the income effect. Given the strong prevalence of non-remuneration for overtime among members of these groups, in addition to the income effect, this finding is not surprising. Furthermore, the elasticity of working hours to wages among workers putting in fewer than 40 hours per week is positive—but small.

Women: among women, too, working hours' wage elasticity is weak in the range of hours that captures most of the population and displays appreciable differences by several personal attributes, foremost the composition of household income (Table 8). In the case of a Jewish single woman who has more than eight years of schooling and who is not a student, the elasticity remains positive up to a job entailing 28 hours of work per week (Figure 5)—a range that captures around one-fifth of women in this group. For Arab women, women with fewer than eight years of schooling, teachers, and widows—the wage effect on working hours is even weaker.

The larger the woman's share in household income, the more strongly her hours respond to wage changes. The likely reason is that a larger share of family income induces greater willingness to make adjustments at home in response to wage changes. The elasticity is even greater when the woman is also a mother, because in this case the substitution considerations also seem to reflect the direct costs of alternative childcare. Consequently, the wage elasticity of hours is slightly larger among married mothers who are secondary breadwinners than among single women. For example, for a mother who brings in one-third of the family income (the vast majority of women who are not sole breadwinners earn 20–45 percent of family labor income), the elasticity falls to zero at 32 hours (35 percent of mothers work less than 32 hours per week) as against 28 hours for a single woman. The negative wage elasticities of hours obtained at jobs entailing 28+ weekly hours are consistent with the large percentage of women who hold jobs of this magnitude who state that they work part-time willingly.[26]

Among women, the elasticity of hours with respect to large wage changes (of more than 10 percent) is greater than the elasticity to small changes, probably due to the threshold effect of the supplemental costs associated with expanding their jobs, and in contrast to our findings about men. Women's working hours' elasticity to large wage changes (calculated as the sum of elasticity to ordinary changes and the coefficient of the large changes) is positive among large population segments in jobs of all sizes, apart from Arab women, students, teachers, and women with up to eight years of schooling. This implies that policy measures striving to raise women's wages substantially (e.g., by raising the minimum wage, introducing an "earned income tax credit" or subsidizing day and afternoon childcare for working women) will affect the working hours of large groups of women (per unit invested) more than those envisaging small increases.

[26] A detailed analysis of the behavior of voluntary and involuntary part-time workers is beyond the scope of this study and appears in Brender and Gallo (2008).

Table 8
Elasticity of Hours to Wage Changes Equations - Women[1]

Explanatory Variables Wage variables	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value
	(1)		(2)		(3)	
Change in marginal wage (%)	0.714	0.000	0.728	0.000	0.566	0.000
Working hours in first period * change in wage	-0.033	0.000	-0.037	0.000	-0.043	0.000
Working hours squared in first period * change in wage	0.0004	0.000	0.0005	0.000	0.001	0.000
Change in personal indicators						
Reached pension age	-0.094	0.000	-0.044	0.011	-0.043	0.012
Became student	-0.084	0.000	-0.102	0.000	-0.101	0.000
Ceased to be student	0.101	0.000	0.142	0.000	0.142	0.000
Joined public sector	-0.116	0.000	-0.118	0.000	-0.119	0.000
Left public sector	0.037	0.000	0.031	0.000	0.032	0.000
Divorced	0.071	0.002	0.067	0.004	0.068	0.003
Had child	-0.042	0.000	-0.048	0.000	-0.049	0.000
Child left household	0.002	0.682	0.015	0.016	0.016	0.011
Spouse stopped working	-0.034	0.001	-0.025	0.013	-0.023	0.022
Demographic variables						
Age			0.009	0.000	0.009	0.000
Age squared			-0.0001	0.000	-0.0001	0.000
Pension age			-0.046	0.001	-0.046	0.001
Single-parent			-0.026	0.001	-0.026	0.001
Single-parent			0.024	0.000	0.025	0.000
Number of children			-0.012	0.000	-0.012	0.000
Number of children under age 5			-0.017	0.000	-0.017	0.000
0-8 yrs schooling			-0.034	0.000	-0.033	0.000
Student			-0.062	0.000	-0.051	0.000
Recent immigrant			0.017	0.000	0.016	0.000
Recent immigrant * age			-0.002	0.002	-0.002	0.003
Long-tenured immigrant -- >10 yrs in Israel			0.109	0.000	0.104	0.000
Ultra-Orthodox			-0.043	0.000	-0.042	0.000
Worker's share in family income			-0.020	0.004	-0.023	0.001
Number of breadwinners in household			-0.005	0.046	-0.006	0.012
Interactions of change in wage with miscellaneous variables						
Changes >10%					0.153	0.001
Number of breadwinners in household					0.074	0.005
Worker's share in family's wage income					0.165	0.032
Widow					-0.238	0.030
0-8 yrs schooling					-0.153	0.032
Student					-0.466	0.000
Arab					-0.263	0.005
Teacher					-0.227	0.016
Occupation -- sales					-0.107	0.039
Mother					0.090	0.065
Working hours in first period	-0.011	0.000	-0.012	0.000	-0.012	0.000
Intercept	0.408	0.000	0.379	0.000	0.377	0.000
Observations	36,324		36,324		36,324	
R-squared	0.153		0.172		0.174	
Adj R-squared	0.153		0.172		0.173	

[1] Control variables for professions (liberal, high-tech, managerial, white-collar) and unskilled were also included in the equations.

Figure 5
Increase in Women's Working-Hours—Simulation of a 10 Percent Change in the Net Hourly Marginal Wage

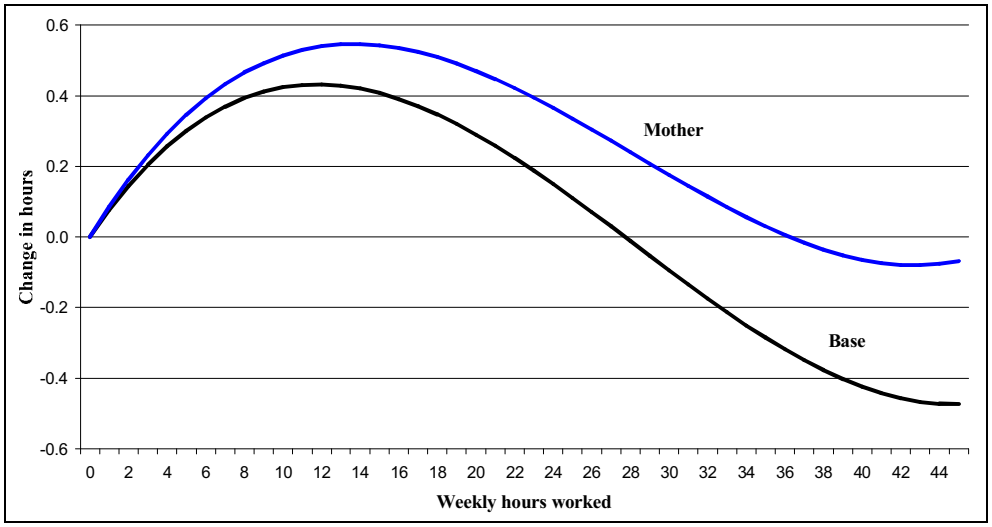


Table 9 tests the effect of wage changes on various groups of women and finds zero wage elasticity of hours among them, similarly to men, even though their jobs are less hours-intensive than men's, i.e., about half of women work fewer than 40 hours per week. This may indicate that the income effect plays an important role in the declining response of hours to wage changes as the extent of the job expands, because the aforementioned

Table 9
Change in Working Hours - Women[1]

Women	Change in working hours in response to a 5% change in wage	Change in working hours in response to a 10% change in wage
Total	-0.072	0.400
Unmarried	-0.086	0.368
Married -- sole breadwinners	-0.086	0.368
Married -- earn up to 35% of family income	0.183	0.518
Married -- earn >35% of family income [2]	-0.060	0.420
Arabs	-0.455	-0.432
Students	-0.629	-0.802
Part-time workers (<40 hours per week)	-0.019	0.337
Part-time workers (<35 hours per week)	0.021	0.372
Part-time workers (<40 hours per week), excl. students	0.029	0.442
Part-time workers (<35 hours per week), excl. students	0.069	0.477
Family income (per standard person) in lowest quintile	0.029	0.459
Family income (per standard person) in highest quintile	-0.152	0.331

[1] Calculated by means of simulation based on Equation 3 in Table 8.
[2] No sole breadwinners.

constraints on changing one's working hours are less effective in job-spans at these levels. Furthermore, although many women hold part-time jobs, Table 9 shows that the elasticities among part-time and full-time working women are basically identical. Another finding in Table 9 is the marked difference between the effect – per NIS spent – of relatively minor and large wage changes.

All the results, for men and women, remained essentially unchanged when we excluded from the sample immigrants and people under age 30—groups that evinced a high loss rate of observations as the sample was built. Also, the exclusion of the ultra-Orthodox (women and men), whose wage estimates were unstable in some years, did not affect the results. Finally, no differences were found in the coefficients among the groups that the Central Bureau of Statistics uses to weight the observations.

b. Personal Attributes and Changes in Them

Changes in workers' demographic attributes have a statistically significant and considerable effect on their working hours, and in the expected directions. We find that reaching retirement age leads to a substantial reduction in working hours among both men and women who continue to work. Students who work during their studies increase their working hours considerably (14 percent) once they complete their studies—beyond the effect of the change in their potential wage—whereas those who begin to study reduce their working hours to a similar extent. Those who begin working in public-sector jobs reduce their working hours and those who leave expand their jobs. Women who gave birth and returned to work in the period between the observations cut back on their working hours, and women who divorced took on more hours in the jobs that they held. The latter finding is consistent with Flug & Kasir' (2006) finding that female single-parents work more hours than married women, but it lends it a dynamic dimension. Furthermore, when one of a mother's children reaches adulthood and leaves the household, the mother extends her working hours slightly. Among men changes in marital status have a noticeable effect: those who get married augment their jobs and those who have a child reduce them. Those whose spouses begin to study expand their jobs, possibly a reflection of the income effect.

In addition to **changes** in workers' demographic characteristics, there are several worker attributes that affect changes in working hours even when the wage change is given. The age coefficients indicate that young people are more inclined to expand their jobs, but the rate at which they do so declines with age (as expressed in the negative coefficient of the age-squared variable). The age at which the age effect turns negative is 36 among men and 34 among women. Workers at pension age tend to reduce their hours more steeply than men in earlier age, a conduct displayed by divorced and single men as well. Workers with the lowest schooling level (0–8 years) increase their working hours less than the better-schooled, and among men the best educated tend to enhance their working hours by more than those with average schooling. Arabs and immigrants, especially when young, and the ultra-Orthodox reduced their working more than other population segments, while fathers increased them more than non-fathers, although the more children they have, the weaker the effect. Among women, the more children they have, especially under five years of age, the less predisposed they are to increase their working hours.

Among women, we found differences in changes in working hours by occupation; this factor that seems to reflect unobserved worker characteristics correlated with occupation. The tendency to increase the number of working-hours stands out among women holding managerial jobs. This finding is consistent with the observed increase in the average working-hours of well schooled women during the study's period. In contrast, women in sales and unskilled jobs tended to reduce their working hours.

Testing the elasticity of working hours to changes in spousal income did not yield statistically significant findings despite the use of various specifications of this variable. Unlike cross-sectional studies on the Israeli economy that identified a positive relation between workers' employment and their spouse's income, in contrast to the theoretical expectation, we found no significant relation between these variables. However, we still did not identify a negative elasticity, as theory would expect, in either of the sexes. These findings are consistent with the difficulty in identifying significant income elasticities in panel studies around the world, and with the weakness of the income elasticities that were found in studies that did identify them. (For a survey, see Alesina et al., 2005.)

6. ELASTICITY OF HOURS TO CHANGES IN GDP

The wage elasticities estimated above may overestimate the response of working hours to policy changes such as tax-rate modifications or employment subsidies. The method employed in this study to estimate wages allows treating them as exogenous to the worker, but workers' ability to adjust their working hours may also be affected by macroeconomic demand: periods of rising wages are usually typified by more convenient job-hunting conditions due to rising demand. At such times, employers would probably be more willing to let workers expand their jobs, permitting workers who wish to do this to accomplish it more easily. Hamermesh (1993, pp.248-269), for example, found that employers facing a decrease in demand for their products respond first by dampening demand for working hours; only later do they adjust headcount. Lilien & Hall (1986) also offer empirical evidence for this. Since the more expedient job-hunting conditions may not exist when exogenous policy measures are applied, these additional demand effects should be neutralized, using appropriate control variables, when analyzing the expected effect of policy measures.

Estimation of the relation between changes in GDP and working hours is also important for macroeconomic analysis. Substantial changes in working hours in response to changes in GDP—which, in this case, reflect both firm behavior (substitution between changing working hours and changing employee numbers) and employee behavior—may shed light on the source of labor-market flexibility at times of strong growth. This happens, for example, in the presence of institutional mechanisms allowing the adjustment of working hours with no effect on hourly wages. When analyzing the elasticity of working hours to GDP, one should also separate short-term growth from longer-term expansion. According to the Calmfors & Hoel (1988) model, for example, one should expect working hours to respond positively to GDP in the short term (foremost on the demand side); in the long term, however, the effect is expected to disappear and the increase in labor input would be

manifested mainly in an increase in employment while working hours revert to their constant level. Such a result would point to demand as the dominant component in the measured relationship between GDP and working hours, while a significant positive relation between changes in lagged GDP and changes in working hours would point to dominance of supply effects. To test this possibility, we include in the equations both the concurrent change in GDP and GDP change at a one-year (and two-year) lag. If the effect of lagged GDP on the working hours of steadily employed persons is negative, it would be consistent with demand dominance in line with Calmfors & Hoel's approach. If the elasticity is positive or zero, however, it would signal that the lack of a long-term trend in average working hours, as presented in the foregoing macro data, is mainly a reflection of the low number of working hours of new entrants to employment, who increase in number at times of growing demand. The relation between GDP and working hours could allegedly also reflect reverse causality – an increase in hours supply leading to higher GDP growth. However, such a mechanism is supposed to operate via wage reductions, a variable included is all the equations along with GDP growth. Additionally, effects in this direction are not expected to affect lagged GDP.

Brender & Strawczynski's (2006) study, and analyses derived from it in Israel Democracy Institute (2006), found differences in the effect of changes in macroeconomic conditions on entry to employment between individuals at different levels of potential wage and among workers who have different levels of family income. These differences were found to contribute to the widening of income disparities at times of growth. To examine whether working hours also contribute to the widening of disparities or constitute a mechanism that narrows them, we test for a difference among workers at different wage levels in the response of working hours to changes in GDP, and for the possibility that workers from high-income families are less inclined to increase their working hours at times of growth than workers from lower-income families. We test this hypothesis by using interaction variables between GDP changes and individuals' and families' income levels (by quintiles). Additionally, and similar to the testing of the effect of wage changes, we test for differences in the effect of growth on the hours of workers of different marital statuses and in accordance with the size of job held by the worker and (if married) his/her spouse.

Another hypothesis is that the response of working hours to GDP changes is stronger for workers with greater specific human capital, whereas in the case of scanty specific human capital a larger portion of the response to demand changes is manifested in changes in the number of persons employed. The Calmfors & Hoel model pointed to this possibility, stressing firm behavior, but from the employees' perspective the willingness to adjust working hours is likely to be larger the larger is the extent of specific human-capital. To test this, we examine whether interaction variables between GDP changes and the worker's economic industry in the first period, or the level of schooling (which may correlate positively with specific human capital), helps to explain the changes in working hours.

Yet another macroeconomic variable that may affect workers' ability to change their hours as they wish, and employers' preference to adjust working hours as opposed to headcount, is the unemployment rate. High unemployment may depress the reservation wage and, therefore, create a preference for a higher headcount at the expense of working hours (given the wage level of the existing staff). We control for the gender-specific

unemployment rate in order to accommodate the possibility of separate labor markets for these groups.

The estimation shows that the relation between wages and working hours, for both men and women, is not affected by the inclusion in the equations of the rate of GDP change. Nevertheless, men's working hours are, as expected, positively affected by GDP growth (Table 10). A 1 percent increase in GDP induces a 0.2 percent upturn in men's working

Table 10
Equations with Addition of Elasticity of Hours to GDP - Men[1]

Explanatory variables	Coeff.	p-value
Wage variables		
Change in marginal wage (%.)	1.083	0.000
Working hours in first period * change in wage	-0.053	0.000
Working hours in first period squared * change in wage	0.000	0.000
Changes in personal indicators		
Reached pension age	-0.042	0.002
Became student	-0.119	0.000
Ceased to be student	0.141	0.000
Joined public sector	-0.092	0.000
Left public sector	0.051	0.000
Spouse became student	0.019	0.036
Got married	0.050	0.000
Had child	-0.014	0.001
Interactions of change in wage with miscellaneous variables		
Worker's share in family's wage income	0.328	0.000
Number of breadwinners in household	0.037	0.010
Wage changes >10%	-0.158	0.000
16+ yrs schooling	-0.173	0.000
Non-academic higher schooling	-0.093	0.005
Student	-0.256	0.001
Became student	-0.245	0.001
Ceased to be student	0.248	0.014
Arab	0.390	0.001
Arab * age	-0.007	0.029
Recent immigrant	0.234	0.000
Ultra-Orthodox	0.246	0.000
Works in public sector	-0.079	0.007
Family income in lowest quintile	-0.082	0.030
Father born in Europe/America	-0.179	0.000
GDP variables		
Rate of change in GDP	0.195	0.000
Rate of change in GDP * academic occupation	-0.227	0.021
Rate of change in GDP * family income in lowest quintile	-0.250	0.006
Rate of change in GDP at 1-year lag	0.124	0.000
Rate of change in GDP at 2-year lag	0.093	0.002
Working hours in first period	-0.011	0.000
Intercept	0.424	0.000
Observations	42,105	
R-squared	0.237	
Adj R-squared	0.236	

[1] The equations also include all the demographic variables appearing in Table 6.

hours. This elasticity is twice that of changes in employment (entering and leaving the labor market) that Brender & Strawczynski (2006) found, indicating the important role of working-hours adjustment in response to changes in labor-input demand across the business cycle.[27] Testing the differences between population groups by demographic attributes, schooling, and occupations, identified only one group that had a significantly different elasticity than the mean: among those who practice academic occupations, the elasticity falls to zero. This result resembles the weak wage elasticity of working hours among the highly schooled, reported above.

Among women, the relation of working hours to GDP is more complex than among men (Table 11). No significant relation was found for most women, but positive and strong elasticity - more than twice that measured among men - was found in several groups that account for 36 percent of women in the sample. These groups include women in occupations that rank low on the wage scale and workers in the youngest age cohort (22–25) and the oldest one (51–60). These groups appear to be the most exposed to unilateral changes in hours by employers at times of GDP contraction and growth.

Testing the difference in working-hours elasticity to GDP by levels of household income, we find large differences in the behavior of men as against women. Among men, the hours' elasticity of workers from households in the lowest labor-income quintile (expressed in labor income per standard person) is far below the average and not significantly different from zero. Among women from such families, in contrast, above-average elasticity was found. It follows that men's adjustment of working hours is a mechanism that, at times of growth, widens income disparities in addition to hourly-wage disparities (Israel Democracy Institute, 2006). The greater elasticity among women, in contrast, helps to narrow the income disparities emerging during periods of growth.[28] The large working-hours elasticity of women in the weakest labor market segments, coupled with the low elasticities of wages to GDP in these groups, depict a mechanism in which, at times of growth, the hourly wages of strong workers rise while women from weak households simply put in more hours.

The one-year-lagged growth rate has a positive effect on men's working hours; at a two-year lag, the effect on working hours is positive among both men and women. This finding is not consistent with the approach positing that working-hours adjustment is a short-term demand response, after which hours return to their optimal level, while the adjustment of labor input will occur via the number of employees. In the Israeli economy, we find no evidence of a negative effect even to a two-year term.[29] Even though this does not constitute a direct test, this finding is consistent with Eckstein and Cohen's (2001) findings on the dynamic effect of on-the-job human-capital acquisition on the persistence of employment. In addition to growth, we found that changes in the level of unemployment had, as expected, a negative effect on change in working hours, foremost among men.

[27] Pro-cyclicality of working hours was found in previous studies (see Castro et al., 2008 and references thereof). The contribution of the current estimation is in identifying the magnitude of this effect in Israel and the differences in its impact on various employee groups.

[28] More than 40 percent of households in the lowest income quintile of households that have working members have a working woman; in a large majority of cases, she is the sole breadwinner.

[29] At shorter lags, too, no negative relation between the variables was found.

Table 11
Equations with Addition of Elasticity of Hours to GDP - Women[1]

Explanatory variables	Coeff.	p-value
Wage variables		
Change in marginal wage (%)	0.526	0.000
Working hours in first period * change in wage	-0.043	0.000
Working hours in first period squared * change in wage	0.001	0.000
Changes in personal indicators		
Reached pension age	-0.039	0.025
Became student	-0.100	0.000
Ceased to be student	0.142	0.000
Joined public sector	-0.117	0.000
Left public sector	0.030	0.000
Divorced	0.067	0.004
Had child	-0.049	0.000
Child left household	0.015	0.019
Spouse stopped working	-0.023	0.021
Interactions of change in wage with miscellaneous variables		
Changes >10%	0.166	0.001
Number of breadwinners in household	0.076	0.004
Worker's share in family's wage income	0.168	0.028
Widow	-0.254	0.020
0-8 yrs schooling	-0.164	0.022
Student	-0.474	0.000
Arab	-0.251	0.007
Teacher	-0.233	0.014
Occupation -- sales	-0.099	0.055
Mother	0.096	0.049
GDP variables		
GDP * age 51-60	0.243	0.021
GDP * age 21-25	0.448	0.003
GDP * "unskilled" occupation	0.485	0.015
GDP * "skilled" occupation	0.448	0.006
GDP * family income in lowest quintile	0.204	0.035
Rate of GDP change at 2-year lag	0.109	0.012
Working hours in first period	-0.012	0.000
Intercept	0.305	0.000
Observations	36,324	
R-squared	0.174	
Adj R-squared	0.175	

[1] The equations also include all the demographic variables appearing in Table 8.

7. CONCLUSIONS AND SUMMARY

This study examined the effect of changes in wages, GDP, and personal attributes on the working hours of steadily employed workers, using repeat observations of individuals' working hours one year apart. The database allowed us to track the change in an

individual's working hours and to test the relation between hours and changes in personal attributes, potential wage, and macroeconomic environment. We found that working hours display weak elasticity to changes in wages and zero elasticity among men who work full-time (about 90 percent of working men). We also found that the wage elasticity of hours is below average among men in the highest income-distribution quintile (accounting the totality of their attributes) and among the highly educated. Among women, the elasticity is especially low among Arabs and students. By implication, the response to wage changes is not the main factor in the observed year-on-year changes in working hours.

Separating the total wage effect into substitution and income effects was not feasible with the current data because they did not include information on whether specific workers are remunerated for expanding their jobs, whether their wage includes an overtime premium, and whether their employers allow them to adjust their hours. For the same reason, we could not examine whether changes that act on the margins, such as changes in marginal tax rates, would have a meaningful effect on the supply of working hours. It is likely that the income effect in changes of these kinds is milder for groups positioned in the range where the policy is effective; therefore, the substitution effect is dominant. However, as stated, it is not clear whether the low elasticity reflects only the income effect or also other constraints on increasing one's working hours.

In contrast to the weak wage elasticity, we found that working hours correlate positively with changes in GDP. That is, the size of the coefficients shows that much of the change in labor demand across the business cycle is satisfied by the adjustment of working hours and not only by changing the number of persons employed. Testing the effect of the changes in lagged GDP, we did not find a correction process, i.e., the working hours of steady workers did not return to their previous level after several quarters of growth, at least not within a two-year term. Among men, positive elasticity was found among most groups except for those in academic occupations, whereas among women the elasticity was positive only in groups on the fringes of the labor market in terms of age and (low-paying) occupations. Since the relation between hours and GDP was included in the equations along with the wage effect, this may reflect institutional constraints to the adjustment of working hours, which are relaxed at times of large changes in GDP. Among women, the large proportion of those aged 51–60 in the group whose working hours correlate positively with GDP change is compatible with this possibility.[30] It also seems that the changes in GDP have stronger effects on groups of women that have weaker bargaining positions vis-à-vis their employers.

Analyzing the effects by income level, we found that among men, changes in working hours at times of growth widen income-distribution disparities in addition to disparities in hourly wages and employment rates. Among women who work in low-wage occupations and among those in the lowest quintile, most of whom are sole breadwinners, hours elasticity to GDP is relatively large and mitigates the widening of income inequality at times of growth. In other words, women in the weak segments of the labor-market increase their hours at times of growth while those in stronger ones enjoy an increase in their hourly wage.

[30] In this group, average working hours decline from year to year.

The database allows us to estimate hours elasticity to changes in spouse's income and not, as in previous studies, only to the spouse's income level. Nevertheless, we were unable to identify a significant negative income effect by means of this variable. However, unlike the results in cross-sectional studies performed in Israel, the coefficient that we obtained is not positive. The estimate of income elasticity derived from the price-elasticity estimates and the interaction with working hours is [–0.02], a magnitude similar to the estimates found in other countries. While attributing the negative effect of the interaction between wage changes and number of hours only to the income effect is a matter for interpretation, especially in regard to full-time workers, the implicit income elasticity is of similar size in respect to less-than-full-time workers as well.

The findings of this study show that the wage effect on working hours is small. However, when estimating the effect on labor supply of policy measures such as changes in marginal-tax rates, it may be useful to be attentive not only to the employment effect but also to the implications for working hours. Future research that identifies the income effect with better precision may contribute to this. A less ambiguous finding emerging from this study is that the elasticities estimated differ across population segments. Therefore, it is important to test the effect of policy measures on income distribution as well. In analyzing policy measures that affect women's income, the magnitude of the change is also very important: large changes in income have a more substantial effect than small ones. Therefore, when dealing with policy measures that aim to affect women's working hours, it would be better to focus them on specific groups, and to do so with greater intensity, than to spread them across large groups. However, when using the coefficients estimated here to assess the expected effect of macroeconomic policy measures, one should bear in mind that the income elasticity estimated on the basis of micro data is different from that measured in macro studies, inter alia because the income effect may be appreciably different when viewed from a macroeconomic perspective than when estimated on the basis of individuals' behavior (Alesina et al., 2005).

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