Bank of Israel **Research Department**

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Sophia Igdalov♠,Roni Frish♥ and Noam Zussman♣

Discussion Paper Series 2017.14

December 2017

Bank of Israel http://www.boi.org.il

♠Research Department, Bank of Israel, sophia.Igdalov@boi.org.il, Tel. – 02-6552645

♥ Research Department, Bank of Israel, roni.frish@boi.org.il, Tel. – 02-6552670

♣Research Department, Bank of Israel, noam.zussman@boi.org.il, Tel. – 02-6552602

We thank David Gordon, Mark Feldman, Orly Furman, Anat Katz-Avraham, and Merav Pasternak from the Central Bureau of Statistics for preparing the data and making it accessible for work in the Research Room, and to Yinon Polak for research assistance. We also thank Kobi Braude, Eran Polizer and the participants in Bank of Israel Research Department Seminar for the helpful suggestions.

Research Department, Bank of Israel, POB 780, 91007 Jerusalem, Israel

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Abstract

This study examines the effect of a tax reform on the incentive to work. The reform implemented in Israel between 2003 and 2009 lowered the marginal income tax of individuals by 7–17 percentage points. The effect of the reform on the incentive to work is estimated by comparing the change in gross wage between individuals who experienced a marked reduction of their marginal tax and others who experienced small reduction. We used panel data from the Income Tax Authority, including wages and tax payments of employees, and merged them with data from Labor Force Surveys.

We found that in the business sector, the elasticity of the gross reported wage relative to the net-of-tax rate (one minus the effective marginal direct tax rate) is about 0.1, within the range of elasticities found in similar studies. Between 2002 and 2009, the net-of-tax rate increased by about 13 percent; Therefore, given the estimated elasticity, the total reported gross wage in the business sector increased by approximately 1.1 percent. The three lowest quintiles did not react at all to the reduction in tax rates, but the elasticity increased with wages, reaching about 0.4 in the upper quintile. We did not find statistically significant differences in elasticity by gender, ethnicity or education. We also did not find a statistically significant reaction to the reform among public sector workers.

תגובת השכר להפחתה בשיעורי מס ההכנסה:
רפורמת המס שנערכה בישראל ב-2003—2009

סופיה איגדלוב, נעם זוסמן ורוני פריש

תקציר

מחקר זה מתמקד ברפורמת המס שנערכה בישראל ב-2003—2009 והפחיתה את מס ההכנסה השולי על יחידים ב-7—17 נקודות אחוז, והוא בוחן את השפעתה על שכר הברוטו. היות שהמס השולי לא הופחת באותה מידה בכל התפלגות השכר, אפשר לאמוד את ההשפעה באמצעות השוואת השינוי בשכרם של פרטים שנהנו מהפחתה ניכרת במס השולי לשינוי בשכרם של פרטים דומים שנהנו מהפחתה מעטה. לצורך האמידה השתמשנו בפאנל שכירים מרשות המסים ובו נתונים על שכרם ותשלומי המס שלהם, וזיווגנו להם את מאפייניהם הדמוגרפיים-חברתיים-כלכליים לפי סקרי כוח האדם.

מצאנו שבמגזר העסקי גמישות השכר המדווח ברוטו ביחס לשיעור הפנוי (אחת פחות שיעור המס הישיר השולי האפקטיבי) עומדת על כ-0.1, כלומר כאשר השיעור הפנוי עולה ב-10% השכר עולה בכ-1%; ערך זה מצוי בטווח הגמישויות שמחקרים דומים מצאו במדינות המערב. בין 2002 ל-2009 עלה השיעור הפנוי בכ-13%; על יסוד הגמישות שנאמדה אפשר להסיק כי שכר הברוטו המדווח במגזר העסקי גדל בכ-1.1%. שלושת חמישוני השכר הנמוכים כלל לא הגיבו להפחתה בשיעורי המס, אך הגמישות גדלה עם השכר והגיעה לכ-0.4 בעשירון העליון. לא מצאנו הבדלי גמישות מובהקים בין גברים ונשים, יהודים וערבים ומשכילים ושאינם משכילים. כמו כן לא מצאנו לרפורמה תגובה מובהקת בקרב עובדי המגזר הציבורי.

A. Introduction

In 2003–2009, the marginal income tax on Israeli individuals was reduced by 7–17 percentage points. The reform was one of the major economic reforms that have taken place in recent decades, and policymakers hoped that it would substantially boost the labor supply and the growth rate, and reduce tax evasion.

Research literature shows that cutting marginal tax rates on income from labor is likely to stimulate a variety of behavioral responses among individuals, including joining the labor market, increasing the number of work hours, raising labor productivity through greater effort, changing jobs, and reducing tax maneuvering and concealment of income. In the long term, it is also likely to affect decisions about education and professional training.

The literature focuses on the intensity of the behavioral responses, since this question is closely related to the optimal structure of the tax system and the degree to which it creates inefficiency (deadweight loss). This question is also at the center of the public discourse: those who support cutting tax rates believe that it increases the labor supply, provides an incentive for economic growth, and also enlarges tax receipts if the economy is on the right side of the Laffer curve. Those who oppose such cuts hold that high tax rates do not significantly affect the labor supply, and are a necessity for a society that wants broad government expenditures and a reduction in economic inequality.

The diverse behavioral responses are eventually expressed in a rise in gross reported income from labor, and the empirical literature since Feldstein (1995) has examined how direct tax rates affect reported income from labor. During the 1980s and 1990s the literature focused on major tax reforms conducted in the US,[1] and in the past decade has also dealt with reforms in Europe.[2] Those studies are based mostly on administrative data about taxpayers' income, and yield different estimates for the elasticity of reported income relative to the net-of-tax rate (one minus the effective marginal direct tax rate),[3]

[1] For example, see Lindsey (1987), Feldstein (1995), and Auten and Carroll (1999).

[2] Reviews of the literature can be found in Gruber and Saez (2002), Giertz (2004), Meghir and Phillips (2010), Saez et al. (2012), Sanz-Sanz et al. (2015), and Neisser (2017). The latest studies include Lehmann et al. (2013), Kleven and Schultz (2014), Carey et al. (2015), Kiss and Mosberger (2015), Creedy et al. (2016), Jongen and Stoel (2016), Kawano et al. (2016), Ziallik (2017), and Matikka (forthcoming).

[3] Elasticity is the rate of change in percentages of reported income when the net-of-tax rate increases/decreases by 1 percent.

as a result of differences in the structure of the tax system and characteristics of the tax reform, the definition of income, the study population, the methodology, the control variable in the estimations, etc. Most of the studies conducted since 2000 found elasticity of 0.1–0.4.[4] Elasticity among the self-employed is greater than elasticity among wage earners, and elasticity among people with high incomes is higher than elasticity among those with low incomes.[5] A few studies included the change in disposable income (the "virtual income") as an explanatory variable. This variable expresses the income effect of the tax reform, since the changes in direct tax rates also apply to the tax brackets below the bracket in which the taxpayer is located, and therefore influence his disposable income, thereby offsetting part of the substitution effect of the changes in the net-of-tax rate on the labor supply. As expected, they found that elasticity relative to virtual income is negative, usually very small (between 0 and -0.1), and frequently not significant.

In Israel, this question has been addressed in a study by Zussman and Romanov (1999). The researchers examined the reform instituted in 1994–1995 in individuals income tax, including changes in payments to the National Insurance Institute and the enactment of the State Health Insurance Law. They found that the elasticity of the annual taxable income of taxpayers (wage earners and self-employed) relative to the net-of-tax rate was 0.06.[6]

The present study estimates the elasticity of gross wages reported to the Israel Tax Authority relative to the net-of-tax rate (one minus the effective marginal direct tax rate). It focuses on wage earners in prime working ages in the business sector in 1998–2010.

[4] To illustrate the point, when the net-of-tax rate is increased by 10 percent – from 70 percent to 77 percent (by cutting the marginal tax rate from 30 percent to 23 percent) – taxable income rises by 1–4 percent.

[5] Studies that estimated the elasticity of work hours relative to wages found that among men, it was usually positive and negligible; among married women, it was in a wider range – in most of the later studies, it varied between 0.2 and 0.5, and it was higher for annual work hours than for weekly work hours – and it was higher among mothers in single-parent families. Reviews of the literature appear in Meghir and Phillips (2010), Keane (2011), and Bargain and Peichl (2016).

[6] Brender and Politzer (2014) used aggregate data from Israel in 1991–2012, and found that the elasticity of total income tax collected from individuals (wage earners and self-employed) relative to the average effective income tax rate was 0.65. The elasticity of the average gross salary per employed position relative to the average effective income tax rate was 0.07. Reducing the average effective income tax rate had a negative effect on gross income. As a result, employees received 65 percent of the benefit, while employers received the rest.

The study relies on a rich database that includes individuals sampled in Labor Force Surveys conducted between 2001 and 2010 by the Central Bureau of Statistics and their demographic, social, and economic characteristics. These individuals constitute a representative sample of Israeli residents in working ages. For each individual, we matched the Israel Tax Authority's files of wage earners for each of the years between 1998 and 2010. These files include the gross wage, compulsory payments, and other particulars enabling us to independently calculate the direct tax liability. We also matched these files with annual demographic data from the Population Registry. In all, the study population includes over 96,000 individuals who were wage earners in at least one of the years covered in the study.

In conformity with the prevailing practice in the literature, we estimated the real change in the reported gross wage between every pair of years separated by three years (hereafter – "earlier year" and "later year") as a function of the change in the net-of-tax rate, the real change in virtual income, the constant and variable demographic, social, and economic characteristics of the taxpayer, and his wage during the earlier year of the pair and in the years before it. We faced similar methodology problems to those faced in the earlier studies: first of all, the level of wages is endogenous relative to the net-of-tax rate: income tax is progressive, and the increase in wages therefore involves a rise in the marginal tax rate. Like earlier researchers, we dealt with the endogeneity problem by applying the tax function of the later year in the pair to the predicted wage for this year (as distinct from the actual wage). Secondly, it was necessary to distinguish the effect of the reform on wages from the contribution of other factors, for example, the expanding trend of inequality in wages resulting from the increase in the return on education due to rapid technological change, globalization processes, etc. The structure of the reform in Israel is helpful in identifying the elasticity of wages relative to the net-of-tax rate, since the tax is differentially reduced over the wage distribution, and is not reduced at a constant rate over time, in contrast to the major reforms in the US, for example, in which the rate of reduction increases with income. Thirdly, income from labor regresses to the mean, and this phenomenon is liable to introduce bias into the estimated elasticity. Like other researchers, we dealt with the problem by (a) adding two control variables to the estimations – the location of the taxpayer in the wage distribution in the earlier year of

the pair and the change in his real wage in the preceding years, and (b) excluding taxpayers with low wages, because the regression of wages to the mean is especially frequent among them.[7]

The main research findings indicate that in the business sector, the elasticity of reported gross wages relative to the net-of-tax rate is approximately 0.1; this value is within the range of elasticities found in similar studies in Western countries. The three lowest wage quintiles did not respond at all to the tax cut, but elasticity increased with income: in the fourth and fifth quintiles it was approximately 0.1 and 0.3, respectively, and in the top decile it was approximately 0.4. For this reason, and because the top quintile earns a much higher proportion of total wages than its proportion of the population, the weighted elasticity according to wages (approximately 0.1) is greater than the non-weighted elasticity (0.03–0.07). The results refer to the change in wages that occurred within three years, even though most of the behavioral response to the tax reform took place within two years. No differences in the elasticity of reported gross wages relative to the net-of-tax rate were found between men and women, Jews and Arabs, or educated and uneducated people. Separate estimations for employees in the public sector found no response among them to the tax reform.

Estimating the weighted elasticity makes it possible to assess how the tax reform contributes to increasing total wage payments in the economy: between 2002 and 2009, the marginal direct tax rate fell by approximately 9 percentage points and the net-of-tax rate rose by approximately 13 percentage points; based on the estimated weighted elasticity, it can be concluded that the reported gross wage in the business sector grew by approximately 1.1 percent (assuming that the capital stock adjusted itself to the increase in labor supply).

The study is organized as follows. Section 2 reviews the changes in direct taxation that took place during the study period. Section 3 presents the database and the study population. Section 4 describes the income tax function that we constructed, and tests the correspondence between the calculated tax liability derived from it and the actual tax

[7] In addition, their wages are affected by revisions in the minimum wage.

liability. Section 5 presents the methodology, Section 6 describes the estimation results, and Section 7 summarizes.

B. The Income Tax Reform and Additional Changes in Direct Taxation during the Study Period

B.1. The Income Tax Reform

In February 2002, the Minister of Finance appointed a Committee for Tax Reform headed by CPA Yair Rabinovitch. The committee submitted its recommendations in June 2002. Among the main recommendations were taxing capital gains; switching from taxation with a territorial connection to Israel to general worldwide personal taxation; and gradually cutting the tax rates on labor income until 2008, because "the high tax rates on income from personal labor cause severe damage. They detract from the desire to work, harm growth, increase the incentive to evade payment of tax, reduce the volume of disposable income remaining after payment of tax, and have a negative impact on the well-being of the taxpayer and his family."[8] The committee recommended reducing the tax mainly for the middle class, arguing that the effective marginal tax rate applied to it was very high by international standards. Furthermore, it even exceeded the tax rate applied to people in Israel with high incomes, because the latter benefited from the existence of a ceiling for payments to the National Insurance Institute and for the health tax.

The committee recommended cutting tax rates according to the level of income: when the level of income ranged from 1.5 to 5 times the average wage in the economy (NIS 10,591–35,820 per month in 2002 prices), the marginal tax rate was cut by 11 to 13 percentage points until 2008; when income was lower, the rate was cut by 4 percentage points; and when income was higher, more than five times the average wage in the economy, the rate was cut by only one percentage point. The format of the cut recommended by the committee appears in Appendix Table A-1.

[8] The quotation is taken from the introduction to the report. See "The Income Tax Reform: Recommendations of the Tax Reform Committee," 2002.

The Knesset passed the committee's recommendations about a month later (Amendment of Income Tax Ordinance [No. 132] – 2002), and additional amendments were enacted in December (Amendment of Income Tax Ordinance [No. 132] [Amendment] – 2002).[9] Just before the reform went into effect in early 2003, the Minister of Finance announced his intention of accelerating it and reaching the target rates in 2006 (instead of in 2008), and a retroactive legislative amendment was therefore enacted (Amendment 134 to the Income Tax Ordinance in the Framework of the Recovery Plan for the Israeli Economy, June 2003). Note that the committee's recommendations and their implementation received extensive media coverage, and it can therefore be hypothesized that the taxpayers were aware of them.

Figure 1 below displays the statutory tax rates in selected years during the period between 1998 and 2010. Only slight changes were made between 1998 and 2002. After the reform went into effect, however (i.e., between 2002 and 2010), the rates were cut substantially by 7 to 17 percentage points, and in a very narrow income range they were cut by 22 percentage points (Figure 2).[10]

In general, the following changes in the structure of the tax brackets and their rates can be cited: in the tax bracket for which the rate was 20 percent, the rate was cut to 10 percent for the bottom part of the bracket, and the bottom part of this bracket was combined with the lowest tax bracket; in the tax bracket for which the rate was 30 percent, the rate was cut to 14 percent in the bottom part of the bracket and to 23 percent in the upper part; in the tax bracket for which the rate was 45 percent, the rates for the lower and upper parts of the bracket were cut to 30 percent and 33 percent, respectively; and in the tax bracket for which the rate was 50 percent, the rates were cut to 33 percent in the lower part of the bracket and only to 45 percent in the upper part of the bracket.

The differential and substantial cut in the statutory tax rates is helpful in estimating the elasticity of wages relative to the net-of-tax rate: had only isolated changes been made along the income distribution, or had changes been correlated with it, we would not have

[9] The extension appears within the Economic Research and State Revenue Administration (2003 and 2005).
[10] In 2003–2008, the tax cut resembled the committee's recommendations at most income levels, but at income reaching 25–100 percent of the average wage it exceeded the recommendations by 7–8 percentage points. In 2008–2010, the tax rates were cut by 2–3 percentage points at all income levels above half of the average wage. To sum up, the cumulative reduction exceeded the recommendations at all income levels.

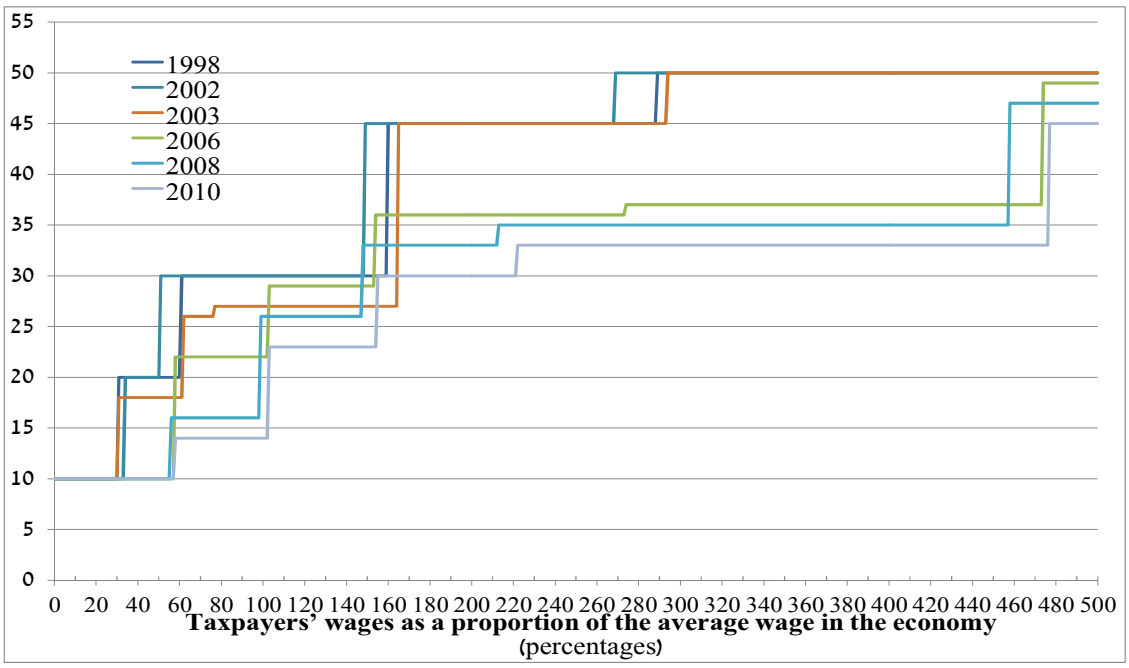
been able to distinguish between the effect of the reform on wages and the effect of other factors; had only small changes been made in the rates, it is possible that no behavioral response would have occurred because of friction, and it is possible that a change would have occurred that would have been difficult to detect.

Figure 3 illustrates the differential character of the cuts in the effective marginal income tax rates. The diagram displays the rates calculated using an income tax function (see Section 4) for pairs of years – for an earlier year and for three years later than that.[11] The diagram shows a considerable variance in the marginal tax rate reduction among taxpayers to whom the same tax rate applied in the earlier year. This fact is helpful in estimating the elasticity of wages relative to the net-of-tax rate, as we will explain later.

Figure 4 shows the substantial differences in the effective marginal tax rates between 2002 (before the tax reform) and 2010.[12] Like Figure 3, it also shows that the magnitude of the cut changes along the wage distribution, and that it is not monotonic. It is worthwhile noting that the tax brackets and the effective tax rates in Figure 4 are consistent with the statutory brackets and the rates reported in Figure 1.

[11] The effective rates for the later year were calculated according to the tax function at that time, and the same function was used for wages in the earlier year, inflated to the later year by the Consumer Price Index.
[12] Appendix Figure A-1 displays the average of the effective marginal income tax rates in each wage decile in 2002 and 2010.

Figure 1 – Statutory Income Tax Rates,[1] 1998–2010 (percentages)



Source: Israel Tax Authority, Central Bureau of Statistics, and analyses by the authors.

(1) Applying to the taxable income (at the ordinary tax rates) of taxpayers who have not yet reached retirement age.

Figure 2 – The Change in the Statutory Income Tax Rates,[1]

2010 in Comparison with 2002 (percentages)

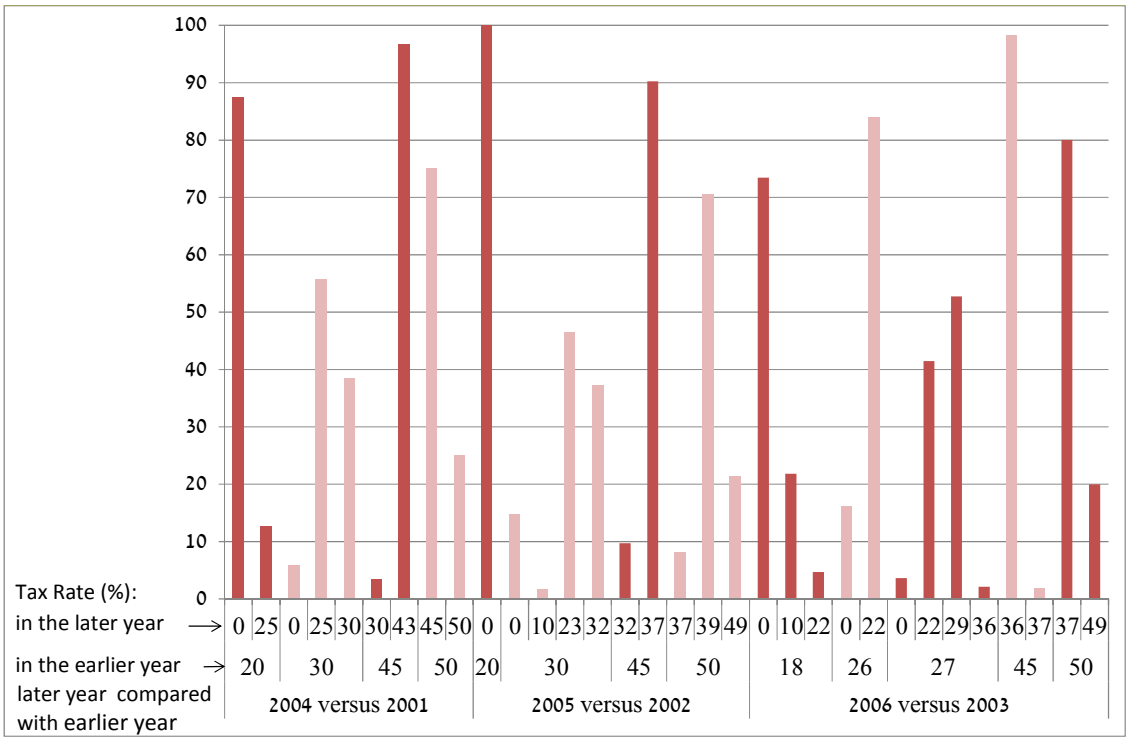
Source: Israel Tax Authority, Central Bureau of Statistics, and analyses by the authors.

(1) Applying to the taxable income (at the ordinary tax rates) of taxpayers who have not yet reached retirement age.

Figure 3 – Effective Marginal Income Tax Rates:[1]

The Tax Rate Distribution in the Later Year, Given the Rate in the Earlier Year, Selected Years (percentages)

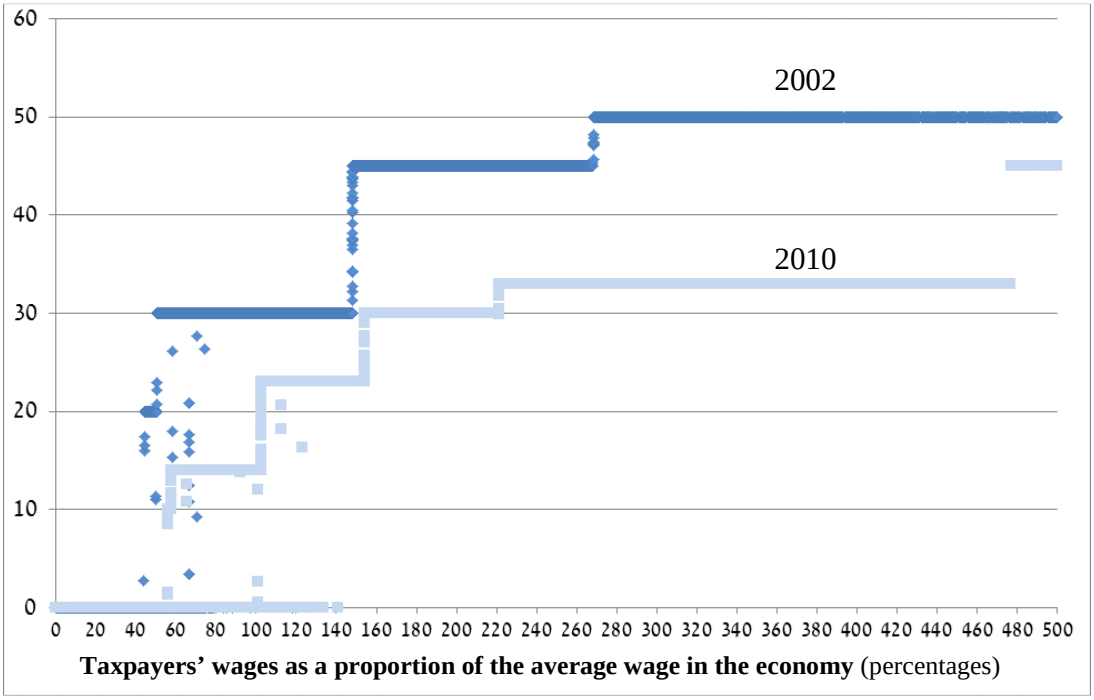
(in each tax rate in the earlier year, the tax rate distribution in the later year total 100 percent)



Source: Israel Tax Authority, Central Bureau of Statistics, and analyses by the authors.

(1) Applying to the taxable income (at the ordinary tax rates) of taxpayers belonging to the study population. We restricted the diagram to wage earners for whom the effective tax rates applying to them in the earlier year were consistent with the statutory rates. We excluded wage earners whose wages were below the income tax threshold in the earlier year, wage earners living in communities that benefited from a tax credit, and wage earners receiving a tax credit for being shift workers. We calculated the effective marginal income tax rate in the later year based on wages in the earlier year (inflated to the later year by the Consumer Price Index).
Three years separate the later year from the earlier year (for example, 2001 and 2004 are a pair).

Figure 4 – Effective Marginal Income Tax Rates,[1] 2002 and 2010 (percentages)



Source: Israel Tax Authority, Central Bureau of Statistics, and analyses by the authors.

(1) Applying to the taxable income (at the ordinary tax rates) of taxpayers belonging to the study population. We restricted the diagram to wage earners with one job who worked throughout the year, did not live in communities benefiting from a tax credit, and did not receive a tax credit for being shift workers.
Every point in the diagram represents one or more wage earners.

B.2. Additional Changes in Direct Taxation during the Study Period[13]

National Insurance Institute Fees and the Health Tax

National Insurance Institute fees and the health tax apply at either reduced or ordinary rates. In 1998–2005, a reduced rate applied to income up to 50 percent of the average wage, and subsequently to income up to 60 percent of it. The reduced rate of National Insurance Institute fees and of the health tax (from age 18 until retirement age) was reduced from 5.76 percent in 1998 to 3.5 percent in 2010. The ordinary rates, which applied to higher incomes (up to a ceiling), rose from 9.7 percent to 12 percent,

[13] Section B.2 completes the description of the changes in labor income taxes. These changes, however, are of little importance in the present context, and familiarity with them is not necessary in order to understand the rest of the article.

respectively.[14] The ceiling for National Insurance Institute fees (and for the health tax) was four times the average wage in 1998–1999 (this is approximately the lower bound of the five upper wage percentiles), and was raised in January 2000 to five times the average wage. The ceiling was canceled from July 2002 until June 2003, and individuals with a very high income from labor had an incentive to found companies in order to reduce their tax liability (Romanov, 2006). When the ceiling was reinstituted, it was set at five times the average wage. Starting in January 2006, the ceiling was raised according to the rate of increase in the Consumer Price Index (instead of the average wage in the economy). From August 2009 until the end of the study period (2010), the ceiling was 10 times the average wage (starting at the beginning of 2012, it was lowered to four times the average wage). Appendix Figure A-2 displays the rates of National Insurance Institute fees and of the health tax in 1998–2010.

Tax Benefits for Communities

The residents of certain communities, mainly in the northern and southern (Peripheral) districts and Judea and Samaria, enjoy tax benefits. The generosity of the benefits reached a peak in 2002, and thereafter was substantially reduced, following a decline in the number of beneficiary communities and the amount of the benefit per resident (see Zussman, 2002; Etkes, 2015). The total estimated value fell from approximately NIS 1.5 billion in 2002 to half of that amount in 2010 (both in current prices; Economic Research and State Revenue Administration, various years).

Introduction of Compulsory Pensions

Starting in 2008, employees and employers were required to make monetary provisions for pensions. The rate of the employees' provisions (employers' provisions) was 0.83 percent (approximately 1.7 percent) for wages up to average wage in the economy; this rate was gradually increased, and in 2010 – the last year in our study – it reached 2.5 percent (5 percent) of wages. Due to the limitations of the data, we do not take the compulsory pension into account, but it appears that this has no real effect on the estimates presented below. First of all, from the employee's perspective, it constitutes

[14] The rates of National Insurance Institute fees and the health tax applying to employers did not change much in 2000–2010: the reduced rate varied from 3.45 percent to 5.93 percent, and the ordinary rate from 4.93 percent to 5.93 percent.

compulsory savings, not a tax, and the labor supply is probably far less affected by the provision than by direct taxes. Secondly, approximately 77 percent of the employees who began making provisions in 2008–2010 earned up to NIS 4,000 per month (and approximately 91 percent earned up to NIS 6,000 per month), while most of the estimations are restricted to those earning wages higher than this threshold; furthermore, in the estimations that are weighted according to wages, little weight is given to those earning low wages. Thirdly, there is a ceiling for the provisions (up to the average wage in the economy). Finally, approximately 30 percent of the wage earners who made no provisions for pensions before compulsory pensions were introduced were not yet making provisions in 2010 (see Ministry of Finance, 2011).

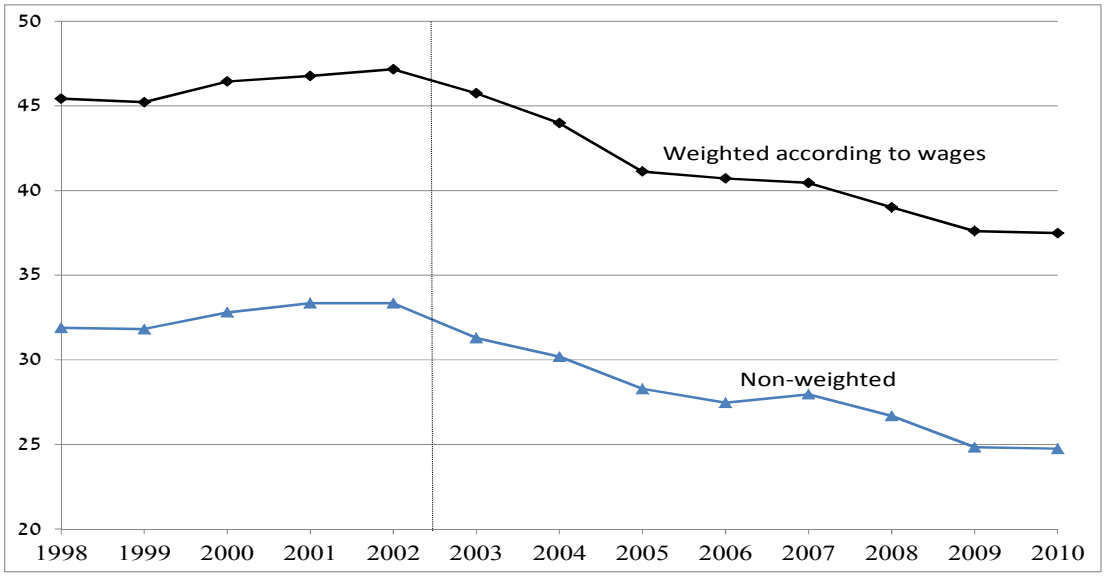
B.3. The Change in the Effective Marginal Direct Tax Rate

Direct tax on employees includes income tax, National Insurance Institute fees, and health tax. The average effective marginal direct tax rate fell steeply during the years of the study (Figure 5). The rate weighted according to wages fell by 9.7 percentage points between 2002 and 2010, and the non-weighted rate fell by 8.6 percentage points. Two notable points in this context: first of all, this decline was far less than the decline in the statutory tax rate, because approximately half of the taxpayers were below the tax threshold (meaning that their effective marginal tax rate was zero). Secondly, among those whose wages were above the tax threshold, the decline in the weighted and non-weighted rates was the same (approximately 9.0 percentage points). It therefore follows that the tax reform was not more beneficial to very wealthy wage earners – a fact that helps us discern how the tax reform affected the labor supply (see Section 5).

Figure 6 displays the net-of-tax rate – one minus the effective marginal direct tax rate – in 2001 and 2010,[15] according to wage deciles. In the middle deciles, the net-of-tax rate rose more significantly with wages, and without any clear trend; in the five highest percentiles (and also in the two lowest deciles) it rose to a negligible extent; and in the seventh decile it rose to a relatively small extent. The net-of-tax rate therefore rises non-monotonically with wages, and this helps us discern how the tax reform affected gross wages.

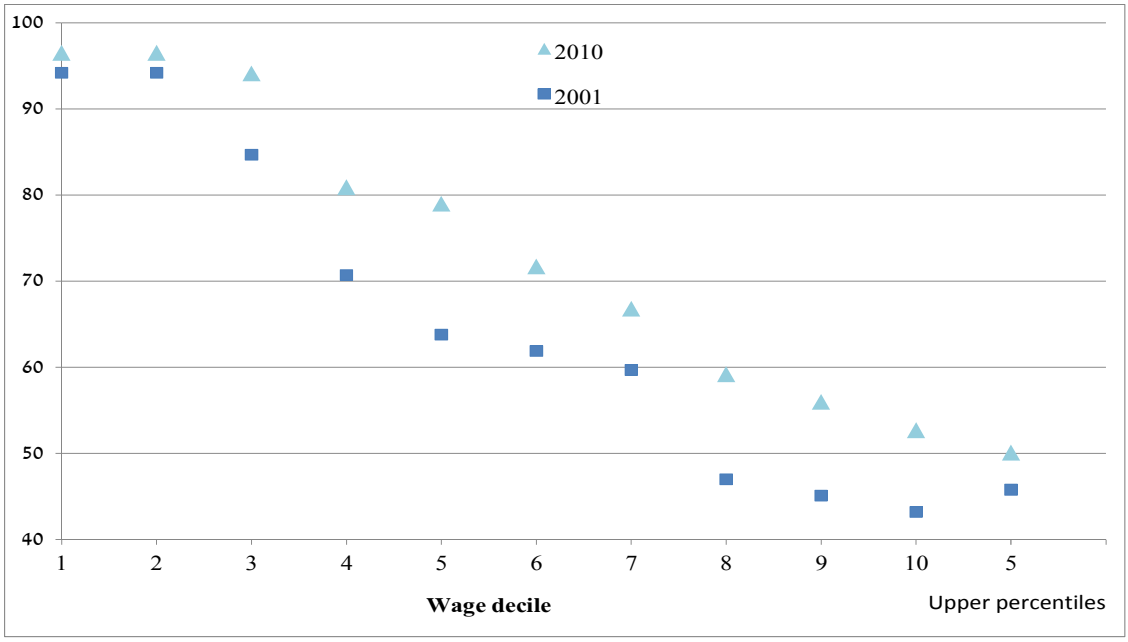
[15] We have chosen to display the net-of-tax rate for 2001, not 2002, because in July 2002 the ceiling for the National Insurance Institute fees and the health tax was canceled for a year, leading to a considerable rise in the marginal direct tax rate applying to those earning especially high wages.

Figure 5 – Average Effective Marginal Direct Tax Rates,[1] 1998–2010 (percentages)



Source: Israel Tax Authority, Central Bureau of Statistics, and analyses by the authors.
(1) The rates of income tax, National Insurance Institute fees, and health tax applying to the taxable income (at the ordinary tax rates) of wage earners belonging to the study population.

Figure 6 – Net-of-Tax Rates[1] according to Wage Deciles, 2001 and 2010 (percentages)



Source: Israel Tax Authority, Central Bureau of Statistics, and analyses by the authors.
(1) One minus the effective marginal direct tax rate (labor income tax, National Insurance Institute fees, and health tax) applying to the taxable income (at the ordinary tax rates) of taxpayers belonging to the study population.

C. The Database and the Study Population

The Database

In order to create the database, we paired all the respondents to the Labor Force Surveys for 2001–2010 with files of wage earners for 1998–2010 according to identification numbers.[16]

The Central Bureau of Statistics conducted the Labor Force Surveys. The sample includes approximately 25,000 new respondents each year, and represents individuals aged 15 and older belonging to the permanent resident population of Israel (see Central Bureau of Statistics, 2011). The survey contains rich demographic, social, and economic information about the respondents, including gender, nationality and religion, date of birth (year and month), country of birth, date of immigration to Israel (year and month), family status, community of residence, education (number of years of study and type of last school attended), participation in the labor force, occupation, and economic sector.

The wage earner files (employee-employer files) are taken from the Israel Tax Authority. The files include the reports sent by employers to the Tax Authority about the income from labor of their employees, a list of tax-exempt income, deductions (including income tax, National Insurance Institute payments, and health tax), type of job (monthly/daily), months of work, and economic sector. They also include demographic and social information originating in the Population Registry: gender, religion, year of birth, country of birth, year of immigration to Israel, family status and identity number of spouse, community of residence, year of death, and more.[17] When the demographic and social information is available on both the Labor Force Surveys and the employee-employer files (including the Population Registry), we preferred to use the second source, for two

[16] The Central Bureau of Statistics improved the data about the identity numbers of the respondents to Labor Force Surveys starting in 2001, and it is therefore possible to pair the survey files with other files. Note that the survey format was changed in 2011.
In 2001–2010, the proportion of respondents whose identification numbers were valid averaged 95 percent. Some of the invalid numbers belonged to permanent residents who had no Israeli identity card (for example, foreign workers). This means that wage earners in the study population were a representative sample of wage-earning citizens of Israel.

[17] In addition to this, we had at our disposal a file including the dates of birth and death (year and month) of (1) children of the respondents who appeared in the Labor Force Surveys, and (2) children of spouses who appeared in the employee-employer files. This information enabled us to calculate the number and ages of children each year for every household in the survey population and, with this information, the amount of child allowances (we have no information about other transfer payments).

reasons. The first is that in contrast to the surveys, the information from the Population Registry is not based on self-reporting, and is therefore more reliable. Secondly, the information in the employee-employer files is updated yearly, if necessary.

Some wage earners held more than one job in a year, and the records in the employee-employer files refer to each of the jobs. We therefore summed the income from labor for each wage earner for all of the jobs that he held during the year, and did the same for tax-exempt income, deductions and credits. The economic sector was determined according to the job that gave the wage earner the highest wage during that year.

For every spouse, we obtained annual data about gross wages, gross income from self-employed labor (from the self-employed files), income tax, National Insurance Institute fees, health tax, and the number of months worked.

The Study Population

We excluded from the study the following populations:

- Individuals outside the prime working age: the study population included only men aged 30–59 and women aged 30–54, because many people below these ages are still studying and many people above these ages have already retired from the labor market.
- self-employed: we excluded respondents who reported[18] income from self-employed labor[19] because the supply of labor of self-employed persons is guided by considerations that differ from those guiding the supply of labor of wage earners, for example, the profitability of the business. We also excluded households in which the spouses were self-employed, because a considerable proportion of these cases involve a family business.

[18] This is reported in the Income Survey, which corresponds to the fourth panel of the Labor Force Survey.
[19] When the Labor Force Survey included both the individual and his or her spouse (for example, because they were already married on the survey date), we were able to use the identity number of the spouse and his or her self-employed income from labor in order to discern the individual's income from self-employed labor. It should be emphasized that we had no access to direct data about the individuals' income from self-employed labor, and we were therefore unable to test the effect of the tax reform on the income of self-employed persons.

- Employees in the public sector: in the public sector,[20] wages are set in collective agreements[21] and employment elasticity is limited in comparison with elasticity in the business sector, for example, with respect to the number of additional work hours. It is therefore difficult to connect wages in the public sector with changes in the direct tax rates, and we therefore excluded public sector employees from most of the estimations, and made separate estimations for them.

- Individuals who lived in an integrated area during the period when work grants were given there: in 2008–2010, a work grant (formerly "negative income tax" and "income grant") was paid to those earning low wages and living in certain communities (the integrated area).[22] Since it is possible that the plan affected the labor supply, we excluded from the study population wage earners residing in the integrated area during the years in which work grants were given (these individuals were included in the study population in earlier years).[23]

- Arabs living in East Jerusalem: we excluded them because they had interactions with the labor market in the territories, and hence they were affected by security events, including the second Intifada.

[20] We used the uniform classification of the economic sectors from 1993, and classified a person as an employee in the public sector if (1) his principal job belonged to the following sectors (orders): public administration, health services, and welfare and nursing services, or (2) his principal job came under the following headings: social and community organizations, community centers, and religious services.

[21] In order to illustrate this, starting at the beginning of July 2003, the salary of workers in the public sector was cut by 4–17 percent for two years, and payment of recreation pay and special seniority bonuses was postponed in the framework of the agreement for the encouragement of growth.

[22] Ar'ara , Ashqelon, Baqa-Jatt, Basma Local Council (a union of the communities of Barta'a, Mu'awiya, and Ein a-Sahala), En Iron, Ein Mahel, Hadera, Jerusalem, Kafr Qara, Kefar Pines, Mishmarot, Nazareth, Netanya , Or Aqiva, Pardes Hanna-Karkur, Upper Nazareth and Sederot. For detail see: Bank of Israel (2011).

[23] In 2005–2010, the Mehalev Program (Wisconsin Plan) and its replacement, "Orot LaTa'asuka," were implemented in four areas in Israel, in order to integrate persons receiving income supplements in the labor market (a discussion appears within the Israel Academy of Sciences and Humanities, 2007; Myers-Joint Distribution Committee-Brookdale Institute and the National Insurance Institute, 2008 and 2010). These programs included 14,900 households (National Insurance Institute, 2011). We chose not to exclude from the study the wage earners living in these areas when the programs were in effect, because few people participated in them, they constituted a limited proportion of the total wage earners in the areas, and the vast majority of them had not previously worked. In any case, we cannot trace the participants in these programs.

- Israelis living in the Gaza Strip: in August 2005, the Israeli citizens living in the Gaza Strip were removed; since this affected the employment patterns of many of them, we excluded them from all the study years.
- Deceased persons: we excluded people who died up until 2010 from all the years of the study, because it is possible that their income was decreased by disease before they died.

The Labor Force Surveys for 2001–2010 included 196,399 respondents (with proper identity numbers) who appeared in the employee-employer files at least once during 1998–2010. These jointly generated 2,553,187 respondent years in 1998–2010 (196,399 x 13 = 2,553,187).[24] We excluded surveyed years according to the following list (there is overlap between the exclusions): outside the prime employment age – 1,356,882; those with family income from self-employed labor – 61,048; employees in the public sector – 741,957; people who lived in the integrated area during the period when work grants were given there – 65,303; people who lived in East Jerusalem – 39,351; Israelis who lived in the Gaza Strip – 3,016; and deceased persons – 9,126. In the end, 96,455 respondents with 745,807 years with positive wages were included in the study population. Appendix Table A-2 displays summery statistics of the study population.

D. The Function for Calculating the Direct Tax on Wages

We calculated the direct tax function[25] applying to wage earners for each of the years in 1998–2010 according to the information available to us. We used the function on the wages received by the taxpayer from all of the jobs he held during the year, since the statutory tax liability is calculated in annual terms. Our tax function assumes that all taxpayers conduct tax coordination, but we are aware that some of them do not do so, and their actual liability is therefore greater than their legal liability.[26]

[24] In a few cases, taxpayers with negative income appeared, and we excluded them.
[25] As mentioned, the direct tax includes labor income tax, National Insurance Institute fees, and health tax.
[26] There is no indication of tax coordination in the employee-employer files.

The Function for Calculating Income Tax[27]

The income tax function (for income taxable at the ordinary tax rates[28]) is based on gross income, tax-exempt income, deductions, tax brackets (see Figure 1), and credits.[29] Note that deductions means the amount withheld from the taxable income, and a credit is the amount reduced from the tax liability. A credit is given in credit points (the monetary value of which varies from time to time) or in a monetary amount.

The information about taxable income at the ordinary tax rates and about tax-exempt income exists in the employee-employer files obtained from the Tax Authority. With respect to deductions, the principal information concerns provisions (up to a ceiling) for an advanced training fund, a provident fund, and premium payments for insurance against loss of earning power. The employee-employer files include detailed information about those deductions in 2006–2010, but the information in 1998–2005 is sparse. In any case, the calculation of the amounts withheld is complicated, and sometimes requires information not found in the files. We therefore preferred to ignore the amounts withheld, and we assumed that they remained unchanged during every pair of years included in the estimations.

There is no list of the credit points in the files available to us, and we therefore calculated them on the basis of the taxpayers' characteristics[30] and the value of a credit point. We took the following credits into account: for being an Israeli resident, for travel to work, for a working woman, for a mother of a single-parent family (or a separated or divorced man or a widower with children[31]), for a non-working spouse, for children up to age 18, and for new immigrants (up to 3.5 years of receiving an immigrant's certificate). We also took into account monetary credits granted to residents of communities entitled to tax benefits and to shift workers.

[27] In order to calculate the income tax function, we used the booklet "Know Your Rights and Obligations: A Guide for Filling out an Individual's Income Form for the Tax Year" published each year by the Tax Authority.
[28] Income from which special tax rates were withheld is listed in the employee-employer files.
[29] This is according to the definition in the Income Tax Ordinance (New Version) – 1961.
[30] Because of a lack of data, we did not take into account some of the credits; the main ones of these were credits for payments to a provident fund and for a life insurance policy.
[31] A divorced or separated man who bears some of the responsibility for providing for his children cannot be detected, and we therefore gave the credit to all of them.

The Function for Calculating National Insurance Institute Fees and Health Tax

The National Insurance Institute fees and health tax applying to wage earners are derived from income subject to National Insurance Institute fees (up to a maximum ceiling during most of the study years) and from tax brackets and tax rates (depending on the age of the insured person). Wages subject to National Insurance Institute fees and to the health tax are reported in the employee-employer files, and we calculated the tax function according to the tax brackets and rates in the National Insurance Law (combined version) – 1995.[32]

The Effective Marginal Direct Tax

Based on the direct tax function, we calculated the direct tax liability and the relevant effective marginal tax rate for each taxpayer. The marginal tax rate was calculated as follows: we calculated the difference between what the taxpayer's direct tax liability would have been, had he earned NIS 100 more per year, and the liability for his actual income, and divided the result by 100. This rate is likely to be one of two values: a) zero – if the increased income does not increase the tax liability, i.e., the taxpayer remains below the tax threshold (the tax credit is greater than the total tax applying to his taxable income), or b) positive – according to the tax bracket applying to his taxable income (and after taking into account tax benefits for communities and a tax credit for shift workers). It is therefore possible for taxpayers with the same reported income to have different effective marginal income tax rates. The effective marginal tax rate of National Insurance Institute fees and of the health tax can be zero only if the taxpayer's income is above the ceiling for income subject to National Insurance Institute fees.

We believe that the effective marginal direct tax rate that we calculated is quite accurate, because it is based on the gross wages reported to the tax authorities and additional comprehensive information. A lack of information about tax credits or deductions is liable to cause errors in calculating the marginal tax rate. Errors in tax credits, however,

[32] In practice, we took their values from the website of the National Insurance Institute. The wage earners who are exempt from National Insurance Institute fees include mostly the severely disabled, individuals whose wages do not exceed 5 percent of the average wage and who receive allowances (except for unemployment insurance) from the National Insurance Institute or a public agency, and new immigrants during their first year in Israel. The wage earners who are exempt from health insurance fees include mainly soldiers and new immigrants whose wages do not exceed 5 percent of the average wage. Because of the difficulty of identifying the exempt groups, we took into account only exemptions for soldiers and new immigrants.

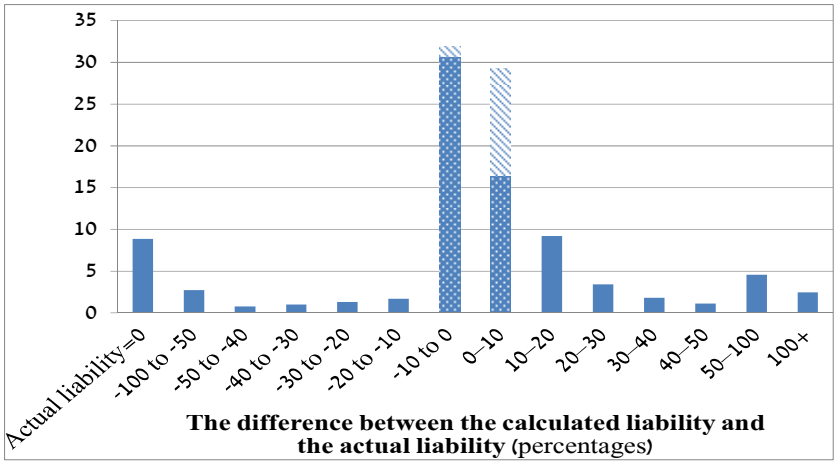
usually do not affect the calculation of the marginal rate (except for when the credits put the taxpayer below the tax threshold). As for errors in deductions, it should be kept in mind that tax brackets are relatively wide, and that in many cases no error in calculating the marginal tax rate will occur even if there is an error in the calculated tax liability.

Figure 7 displays the distribution of the difference between the calculated direct tax liability and the actual liability according to the employee-employer files. The difference is less than 10 percent in the vast majority of cases. Figure 8 displays a diagram of the calculated income tax liability versus the actual liability, and Appendix Figure A-3 displays a similar picture for the National Insurance Institute fees and health tax liabilities. It can be seen that most of the taxpayers are close to the 45–degree line. The diagrams therefore show that the direct tax function that we constructed is quite accurate. At the same time, we restricted some of the estimations to taxpayers for whom this difference does not exceed 10 percent, and we also conducted a sensitivity test for a deviation of up to 5 percent.

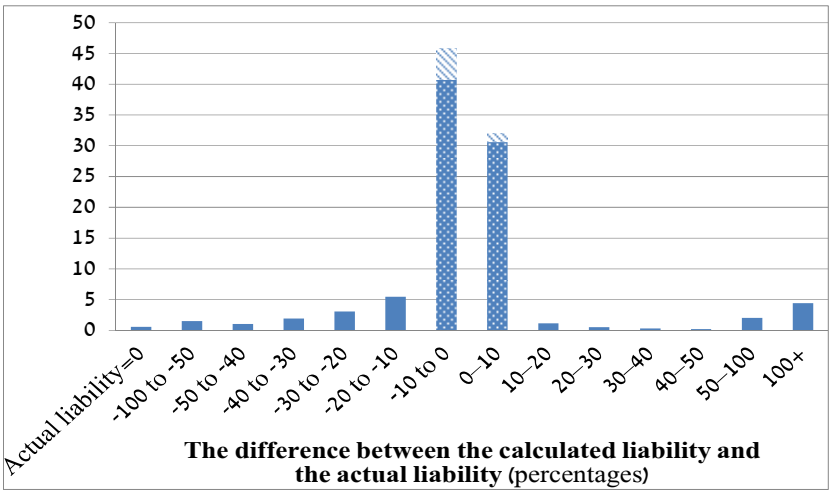
Figure 7 – The Distribution of the Difference between the Calculated Annual Direct Tax Liability Applying to Wage Earners and the Actual Liability,[1,2] 1998–2010

(percentages)

A. Income Tax



B. National Insurance Institute Fees and Health Tax



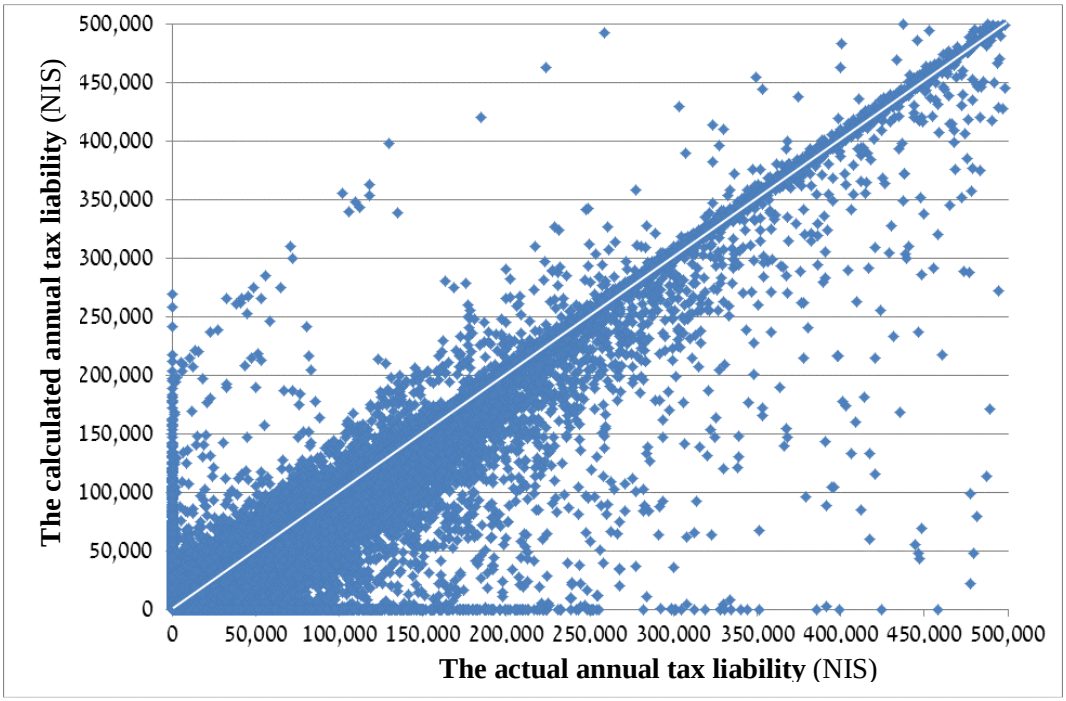
Source: Israel Tax Authority – employee-employer files; the Central Bureau of Statistics – Labor Force Surveys and the Population Registry; and analyses by the authors.

(1) [(The calculated liability minus the actual liability) divided by the actual liability] multiplied by 100. The taxpayers belong to the study population.

(2) The dotted areas denote a difference of up to 5 percent, and the areas with diagonal lines denote a difference between 5 percent and 10 percent.

Figure 8 – The Calculated Liability for Income Tax Applying to Wage Earners in Comparison with the Actual Liability,[1] 1998–2010

(thousands of NIS in 2010 prices)



Source: Israel Tax Authority – employee-employer files; the Central Bureau of Statistics – Labor Force Surveys and the Population Registry; and analyses by the authors.

(1) The taxpayers belong to the survey population. Each point in the diagram represents one or more taxpayers.

E. Methodology

The study main goal is to examine the effect of the reduction in the marginal direct tax on gross annual reported wage, since the change in wages expresses a behavioral response reflected in working hours, tax evasion, etc. In practice, we estimated the change that occurred in the taxpayer's wages between two years (earlier and later) as a function of the change in the net-of-tax rate (one minus the effective marginal direct tax rate) and control variables.

The estimation method is essentially similar to difference–in-differences method: the difference (in percentages) between taxpayer wages in the later year – after a given change in the net-of-tax rate is applied to him – and his wages in the earlier year is calculated. The result is then compared with the corresponding difference for other

taxpayer to whose wages a different change in the net-of-tax rate was applied. The comparison is conducted with a control for the taxpayer's wages in the earlier year, his personal characteristics, etc., as explained below. It therefore follows that all of the developments in the labor market that are not correlated with the change in the net-of-tax rate will not affect the results of the estimations, because their effect is the same for all taxpayers, and is offset by the second difference. It should be noted that the absolute value of the correlation between the taxpayers' constant and variable personal characteristics – for example, gender, age, religion, family status, level of education, and area of residence – and the change in the net-of-tax rate does not exceed 0.05; in other words, even if developments occurred in the labor market that had a differential effect on individuals with different personal characteristics, they are not correlated with the change in the net-of-tax rate.

It should be noted that the macroeconomic effects resulting from the tax reform itself will not make the estimates biased either, because they affect all taxpayers, and are offset by the difference–in-differences method. For example, assume that the tax cut causes employers to reduce their employees' gross wages. The difference in differences between the employees who benefited from the cut in the marginal tax rate and similar employees who did not benefit from it will still allow an unbiased estimation of the elasticity of the gross wages relative to the net-of-tax rate.

According to our definition, the marginal direct tax rate is equal to the cumulative marginal rate of all the direct taxes levied on gross wages, namely, income tax (at the ordinary rates), National Insurance Institute fees, and health tax.

In accordance with the prevailing practice in studies in this field, we evaluated the real change that occurred in reported gross wages within three years (for example, 2004 compared with 2001). This made it possible to compare our estimates to others. Studies use this period of time for two main reasons. First, a shorter period of time poses difficulties: the process of adaptation in the labor supply to the tax reform is gradual because, among other things, it takes time for the information about the reform to penetrate, people's habits tend to persist, and making adjustments (such as replacing an employer) takes time. Furthermore, in the short term, taxpayers are likely to spread their

income from labor over more than one year – or even change its volume – in order to reduce their tax liability, while we are interested in the response to the reform in the long term (the permanent response). On the other hand, there is a disadvantage in selecting a longer time period, because the inter-period correlation in wages diminishes, and this is liable to make it difficult to detect the effect of the reform.

The studies examining how changes in the tax rates affect the labor supply encounter four major methodological problems: endogeneity of tax rates, regression of wages to the mean, long-term wage trends, and the degree of exogeneity of the tax reform, as explained below.

Endogenous tax rates. Direct taxation is progressive, and the marginal tax rate therefore depends on the income level. A naïve estimation of the change in wages as a function of the change in the actual net-of-tax rate will consequently lead to the erroneous conclusion that there is a positive correlation between an increase in the tax rate and an increase in wages. In order to deal with this problem, it is customary to calculate the marginal tax rate in the later year according to the tax rates that would have applied to the income at the time, had the reform not taken place. Since this counterfactual income is unknown, various methods are employed to estimate it. Most studies assume that the income in the later year is the same as in the earlier year in constant prices,[33] and we also usually made this assumption. We will present other estimations based on a projection of the wages for the later period on the basis of wages in the earlier year and other variables.

Regression of wages to the mean. In the transition from the earlier year to the later year, the average wage of those who earned relatively little (much) will increase (decrease), compared with the earlier period. The phenomenon of regression to the mean is frequent mainly at the extremes of the wage distribution, and is liable to make the estimates biased. For example, if the tax rates are cut for those earning high wages, and they choose to work more in order to increase their wages, then regression to the mean is liable to make the actual wage increase at a relatively moderate rate, if at all, and the estimate for the elasticity of wages relative to the net-of-tax rate will therefore be downwardly biased.

[33] This also preserves the constant tax brackets, since the nominal tax brackets are likely to be revised according to the rate of increase in the Consumer Price Index.

In order to deal with the problem, it is customary to include the following explanatory variables in the estimations: wages in the earlier year (or dummy variables for the wage decile in the earlier year) and the trend of the taxpayer's wages in the years preceding the change in the tax rate.

In addition, it is customary to exclude the individuals at the ends of the wage distribution from the estimations. Those earning low wages are excluded not only because regression to the mean is common among them, but also for two other reasons: first of all, the effective marginal tax rates applying to them are likely to be very high, because an increase in income from labor involves a loss of transfer payments and benefits in kind. Secondly, raising the minimum wage affects the wages of those with low incomes,[34] and is therefore liable to make the estimates for the elasticity of wages relative to the net-of-tax rate biased. Appendix Figure A-4 displays the development of the minimum wage in Israel during the study years. The figure shows that the annual minimum wage for a full-time wage earner reaches NIS 31,000–37,000 (in 1998 prices), and the fluctuations in its value are mainly a result of it being updated annually according to the rise in the average wage in the economy, or following a cost of living increment, as well as its being frozen in 2001–2005. In the study, we therefore restricted some of the estimations to individuals whose wages exceeded NIS 40,000 per year in 1998 prices – an amount equivalent to 56 percent of the average wage per employed person in the economy (or in the business sector) in 1998;[35] this rate is in the customary range of restriction in similar studies elsewhere in the world.[36] The wealthiest taxpayers are also excluded not only because of regression to the mean, but also because their income is very volatile, and this is liable to

[34] This includes individuals whose wages exceeded the minimum wage to some extent.

[35] The minimum income tax threshold for wage earners during the study period was approximately NIS 30,000 (in 1998 prices) – see Appendix Figure A-4. Wage earners who earned less than the tax threshold, both in the earlier year and the later year, were not affected by the tax reform, and there was therefore no reason to include them in the estimations (regardless of the level of the minimum wage). Note that the restriction of the estimations to those earning more than NIS 30,000 a year (instead of NIS 40,000) yields slightly lower estimates, as expected (on a scale varying between 0.01 and 0.02 percentage points).The results can be obtained from the authors.

[36] Auten and Carroll (1999) excluded US citizens whose annual income from labor was over $20,000 – about two-thirds of the average annual income from labor during the study period; Gruber and Saez (2002) excluded individuals whose income was below $10,000 – about one-third of the average income; and Creedy (2016) excluded New Zealand citizens whose annual income from labor was over $16,000 – about two-thirds of the average income (the figures for average annual income from labor were taken from publications by the US Bureau of Labor Statistics and Statistics New Zealand).

distort the results of the estimations (for example, see Gruber and Saez, 2002). Thus, we also excluded individuals whose wages were in the top three thousandths.[37]

Long-term wage trends. Inequality in wages widened in recent decades in many countries as a result of rapid technological change, expansion of international trade, a decline in workers' unionization, etc. This trend, which caused a more rapid rise in the wages of employees with expertise earning relatively high wages, is liable to make the estimates of the elasticity of wages relative to the net-of-tax rate upwardly (downwardly) biased among those with high (low) wages. This problem can be dealt with in several ways. For example, it is possible to include control variables for individual characteristics, including level of education, economic sector, and so forth. First, however, one should evaluate whether these trends affected the study population.

In Israel, inequality in gross wages (according to the Gini Index) widened moderately during the study period until the middle of the preceding decade (around 2005), and then stabilized, and even decreased to some extent (Bendelack, various years; Dahan, forthcoming; Economic Research and State Revenue Administration, various years). We learn from Appendix Figure A-5 that during the study period, the proportion of total gross wages received by those with high wages declined.[38] The tax rates, however, were not cut in a manner correlated with the level of wages and, in any case, they were cut at a different pace in different time periods, and at different wage levels (see Section 3 above).

Exogenous tax reforms. Tax reform is likely to occur following a significant macroeconomic developments. In such a situation, we are likely to attribute to the reform a response that is actually partly due to these developments. The reform in Israel was planned and approved during 2002, when a recession prevailed in the economy as a result of the second Intifada, and its implementation began just before the economy emerged

[37] Like other researchers, we also excluded taxpayers whose income changed greatly between the two years in the pair (for example Gruber and Saez, 2002, excluded taxpayers whose wages changed by a factor of 1,000). We chose to exclude taxpayers whose wages increased or decreased by a factor of 100 or more between the years in the pair (481 and 447 pairs of taxpayer's years, respectively). Sensitivity analysis show that had we excluded taxpayers whose wages grew/decreased by a factor of 10 or more, the estimates would have remained almost unchanged.

[38] In the estimations, we controlled for a range of taxpayers' socioeconomic characteristics. If these characteristics are correlated with the long-term trends of the changes in the wages distribution, the control reduces the bias in the estimations.

from the recession. The report by the Committee for Tax Reform indicates that its recommendations were not due to considerations related to the business cycle. Rather, they originated in a desire to encourage economic activity in the long term and to correct distortions in the tax system.

Fluctuations in economic activity in Israel occurred during the study period – the economy entered a recession in the wake of the second Intifada, and grew rapidly in the ensuing period – and these events were reflected in the state of the labor market, including in gross wages. However, as long as such developments in the supply and demand sides of the labor market are not correlated with the changes in the net-of-tax rate, no bias will be created in the estimates for the elasticity of wages relative to the net-of-tax rate, since such developments affect all taxpayers to the same degree (and, as noted, will be offset by the second difference calculated in the difference–in-differences approach). As noted, the changes in the net-of-tax rate are not correlated with the level of wages or with the wage earners' characteristics,[39] and there is therefore no reason to assume that bias will be created in the elasticity estimates.

In the first half of the preceding decade a policy design to move people from welfare to the labor market was implemented in Israel: transfer payments were cut (child allowances, unemployment insurance, income supplements, etc.), and the terms for receiving them were made stricter. As a result, an increase in the labor supply of individuals with poor earning ability occurred, including ultra-Orthodox men and Arab women – population groups that also responded to other changes (for example, the introduction of the "Tal Law"; see Deutsch, 2017) – and it is possible that this eroded the wages of individuals with poorer earning ability. This can affect the estimated elasticity of wages relative to the net-of-tax rate, but this bias is probably very small: first of all, most people earning low wages did not benefit from the tax reform, since their wages were below the tax threshold both before and after the reform. Secondly, we weighted the estimations according to wages, or restricted it to individuals earning over NIS 40,000 a year.

[39] The fluctuations in the labor market are likely to have a differential effect on wage earners with different characteristics, for example, men and women.

The estimated equation

In order to estimate the effect of tax rates on gross wage, we used Equation (1) below, similar to the equation used in Gruber and Saez (2002) and many of the studies conducted later (for simplicity, we excluded the index of the pair of years):

$$(1)\quad \ln(Z_3^i / Z_0^i) = \alpha + \beta \cdot \ln\{(1-T_3^{'}(\hat{Z}_3^i))/(1-T_0^{'}(Z_0^i))\} + \delta \cdot \ln\{(\hat{Z}_3^i - T_3(\hat{Z}_3^i))/(Z_0^i - T_0(Z_0^i))\}$$
$$+ \gamma_1 X^i + \gamma_2 \Delta X_t^i + \eta D_0^i + \lambda_1 \ln(Z_0^i / Z_{-1}^i) + \lambda_2 \ln(Z_{-1}^i / Z_{-2}^i) + \mu_t + \varepsilon^i$$

where Z_j^i is the reported gross wage of taxpayer *i* in the earlier year (*j*=0) or the later year (*j*=3), in prices of the earlier year. Therefore $\ln(Z_3^i / Z_0^i)$ reflects the real rate of change in wages.

$T_j^{'}(Z_j^i)$ is the effective marginal direct tax rate (income tax, National Insurance Institute fees, and health tax) applying to the taxpayer's wages in the earlier/later year. Therefore $1-T_j^{'}(Z_j^i)$ reflects the net-of-tax rate, while $\ln\{(1-T_3^{'}(\hat{Z}_3^i))/(1-T_0^{'}(Z_0^i))\}$ reflects the change that occurred in the rate following the reform.

$\hat{Z}_3^i$ is the gross reported wages that taxpayer *i* would have received in the later year without the reform, in prices of the earlier year. Here we assume that the real wage in the later year would have remained the same as the wages in the earlier year without the tax reform (we will later present a different approach to calculating the projected wages in the later year).

$T_j(Z_j^i)$ is the calculated tax liability applying to the wages of taxpayer *i* in the earlier/later year. The expression $\ln\{(\hat{Z}_3^i - T_3(\hat{Z}_3^i))/(Z_0^i - T_0(Z_0^i))\}$ reflects the real change in virtual income resulting from the reform.

X^i is a vector of constant characteristics of taxpayer *i* – gender, nationality and religion, and level of education.[40]

[40] The level of education is determined according to the last school at which the respondent studied as of the date on which he participated in the Labor Force Survey. We assumed that this was also his level of education in each of the study years, since we restricted the estimations to people age 30+. We divided the

ΔX_t^i is a vector of variable characteristics of taxpayer *i* in year *t*: age (and the age squared) in the later year; the number of children up to age 18 in the household in the later year, the number of children born in the earlier year, the number of children born in the later year, and the number of children born between the years; the family status in the later year and the change that occurred between the earlier and later years (a transition from single to married or vice versa); the economic sector and the district of residence in the earlier year.

During the study period, significant changes took place in the level of child allowances.[41] We therefore also added to the explanatory variables the calculated change that occurred in the child allowances received by the household between the earlier and later years, and took into account only the children born before the earlier year.[42]

D_0^i is a dummy variable for the gross reported wage decile of taxpayer *i* in the earlier year of the pair (and a dummy variable for each of the wage percentiles in the top decile). This variable is designed to deal with the regression of wages to the mean.

Z_{-1}^i is the gross reported wage of taxpayer *i* in the year before the earlier year (year -1). It follows that that the expression $\ln(Z_0^i / Z_{-1}^i)$ expresses the real change that took place in gross wages between this year and the earlier year. We included this expression in the estimation in order to neutralize the long-term trends in the taxpayer's wages.

Z_{-2}^i is the gross reported wage of taxpayer *i* two years before the earlier year (year -2). It therefore follows that the expression $\ln(Z_{-1}^i / Z_{-2}^i)$ expresses the real change that took place in gross wages between this year and year -1.

μ_t is a dummy variable for year t, reflecting macroeconomic and other effects on wages.

ε^i is a random error.

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level of education as follows: high school or below, additional non-academic education, academic education, yeshiva (Jewish religious seminary), and other education.

[41] See National Insurance Institute annual report (various years) and Toledano et al. (2012).

[42] This is because the tax reform is likely to affect the fertility rate. The calculation is based on the level of the allowances according to the order of the child.

Two estimates are the focus of interest in the study: β – the compensated elasticity of the of the reported gross wages relative to the marginal net-of-tax rate, and δ – the elasticity of the reported gross wages relative to virtual income (the income effect). Most of the studies omitted the "virtual income" explanatory variable and therefore, in these cases, the estimate β expresses the uncompensated elasticity of the reported gross wages relative to the marginal net-of-tax rates.

Most studies conduct weighted estimations according to gross wages, because the elasticity of wages relative to the net-of-tax rate usually increases with wages; hence the weighted elasticity is likely to show how the tax reform affects total labor income – and therefore how it affects GDP and, indirectly, tax receipts. It is impossible, however, to conduct a weighted estimation when the explanatory variables also include the change in virtual income; see Gruber and Saez (2002).

Our study deals with two methodological problems that have not been appropriately addressed in previous studies. The first concerns our calculation of the main explanatory variable – the change in the individual's effective marginal tax rate – according to the tax model we devised (as earlier studies did); in other words, it is not an official figure from the Israel Tax Authority. Since errors in measuring the variable in question will make the estimates biased in the direction of zero, we conducted sensitivity tests: we excluded from the sample all the wage earners with a difference of more than 10 percent (or more than 5 percent) between the tax liability that we calculated for them and their liability according to the Israel Tax Authority. We also conducted a sensitivity test by excluding the wage earners for whom the difference-in-differences between the earlier and later years exceed 10 percent.[43]

The second problem also concerns a possible bias in calculating the change in the marginal tax rate. Since the marginal tax rate is derived from wages, the regression of wages to the mean also affects its calculation. Earlier studies have dealt satisfactorily with the problem of regression to the mean in the *dependent* variable, but it is doubtful

[43] This restriction reduced the number of wage earners who participated in the estimation by only 2 percent. It can therefore be concluded that there is an inter-period correlation between the errors in the tax liability calculation caused by not taking into account unobserved constant characteristics of the wage earners (for example, receiving credit points for children with disabilities).

whether this handling also eliminates the problem in the calculation of the main *explanatory* variable – the change in the marginal tax rate (see Creedy et al., 2016). We therefore chose also to present estimations in which the calculation of the main explanatory variable is not based on the actual wages in the earlier year (and on inflating it to the later year according to the Consumer Price Index), but rather on the projected wages for the later period (and deflating the projected wage by the Consumer Price Index to get the wages for the earlier period). The regression to the mean problem does not occur with the projected wages, and the same is true for the marginal tax rate derived from them; this rate is used to calculate the change in the net-of-tax rate.

The projected wage for the later year is estimated in the literature through the wage in the year preceding the tax reform and the demographic, social, and economic characteristics of the taxpayers (see, for example, Blomquist and Selin, 2010). We therefore used the following estimation:

$$(2)\quad Z_3^i = \alpha + \beta_1 Z_0^i + \gamma_1 X^i + \gamma_2 \Delta X_t^i + \lambda_1 \ln(Z_0^i / Z_{-1}^i) + \lambda_2 \ln(Z_{-1}^i / Z_{-2}^i) + \mu_t + \varepsilon^i$$

where the symbols representing the variables are as listed above. With the help of the estimates, the projected wage of individual *i* in the later year can be derived and used to replace $\hat{Z}_3^i$ in Equation (1). More specifically, the projected wage in the later year $(\hat{Z}_3^i)$ in the prices of the earlier year replaces Z_0^i in the explanatory variables in Equation (1), similar to the approach taken in the original estimation of Equation (1).[44]

[44] An alternative estimation of the projected wage for the later year is
$\{(Z_3^i - \overline{Z}_3) / \overline{Z}_3\} = \alpha + \beta_1 \cdot \{(Z_0^i - \overline{Z}_0) / \overline{Z}_0\} + \gamma_1 X^i + \gamma_2 \Delta X_t^i + \lambda_1 \ln(Z_0^i / Z_{-1}^i) + \lambda_2 \ln(Z_{-1}^i / Z_{-2}^i) + \mu_t + \varepsilon^i$
where $\overline{z}_j$ represents the average gross reported wage in the earlier year (*j*=0) (in constant prices of the later year) or in the later year (*j*=3), and where the other symbols represent variables as listed in Equation (2). The elasticities estimated on the basis of this equation (not displayed) are similar to those obtained on the basis of Equation (2).

F. Results of the Estimations[45]

Table 1, which is based on Equation (1), displays the principal results of the estimation of the factors explaining the change that occurred in the annual gross reported wages after three years. In the estimation for all wage earners (Column 1), the elasticity of wages relative to the net-of-tax rate is approximately 0.03; in other words, an increase of 1 percent (in contrast to one percentage point) in the net-of-tax rate increases the gross wage by 0.03 percent. When the estimations are restricted to people earning over NIS 40,000 a year, as is customary in the research literature, the elasticity increases, reaching 0.05 (Column 2).[46] This phenomenon, which is well documented in the literature, is due first and foremost to those with low wages being below the tax threshold; furthermore, those earning high wages have more opportunity to respond to changes in the tax rates, because they have more control over their work time, and they can also divert income from capital to labor or vice versa. Appendix Figure A-6 displays the correlation between the change in the net-of-tax rate and the change in the real wage among taxpayers who were above the tax threshold in the earlier year. The elasticity obtained – without control variables (including for regression to the mean) – is similar to the elasticity that was estimated among those earning over NIS 40,000 a year (Column 2).

Many studies have used estimations weighted according to wages in the earlier year to estimate how the tax reform affects the wage earners' total wages and through them two other amounts: (1) GDP, since the remuneration for labor constitutes nearly two-thirds of GDP, and (2) tax receipts, since the taxpayers' wages constitute the direct tax base. The weighted estimations (Columns 3–5) show that the elasticity of gross wages relative to the net-of-tax rate is about 0.07 among those with positive wages, and reaches 0.10 when individuals earning less than NIS 40,000 a year are excluded. These elasticities are higher than the elasticities found in the non-weighted estimations, because elasticity increases with wages. Since it is particularly high in the top decile (see Table 2 below), the

[45] In all the estimations in this section, we excluded taxpayers who benefited from a tax credit for shift work (approximately 8,500 individuals), since we could not identify them for sure in 2006–2010. The estimations that do include them yielded similar estimates to those presented in the section.

[46] The restriction is applied to the gross wage in the earlier and later years. Replacing the restriction in the later year with a restriction only on positive wages makes almost no difference in the estimates of the elasticity of wages relative to the net-of-tax rate.

weighted elasticity drops to 0.04 when the five highest percentiles are excluded from the estimations.

The elasticity of wages relative to virtual income – which reflect the income effect of the tax reform – is negative, as expected (-0.06), but is not statistically significant, including among people whose annual wages are over NIS 40,000. The control variables affect the rate of increase in the reported gross wage in the expected directions. The pace slows with age – in accordance with the way that the wage profile develops during life – and is lower among women, non-Jews, people with less education, unmarried people, and taxpayers with children born after the earlier year (especially women; the result is not displayed). The estimates of the dummy variables for the deciles (not displayed) fall significantly as the decile rises – a phenomenon that reflects the regression of wages to the mean. Similarly, when the increase in wages before the earlier year is faster, it slows between the earlier and later years. An increase in child allowances reduces wages, due to the income effect.

Wages in the following branches of the business sector rose significantly faster than in traditional industries (the list is in increasing order according to the relative rate of increase; the results are not displayed in Table 1): transportation, storage and mail; computer services and research and development; advanced industries; banking, insurance, and other financial institutions; electricity and water. Wages fell in the following branches compared with wages in traditional industries (the list is in increasing order according to the relative rate of decrease; the results are not displayed): construction; wholesale and retail trade; hosting and food services; "private" community and social services; and other personal services. In the northern and southern districts, as well as in Judea and Samaria, wages fell relative to wages in the Tel Aviv district (the result is not displayed). Adding variables for the interaction between district and year – in order to control for the possibility that the labor market (the unemployment rate, for example) developed differently in different areas – left the elasticity estimates almost unchanged. Note that omitting the control for demographic and social variables (gender, age, religion, education, family status and number of children, economic sector, and district of residence) has almost no influence on the estimates for the elasticity of wages,

relative to the net-of-tax rate; on the other hand, the control for regression of wages to the mean has a strong effect on the elasticity estimates (the two findings are not displayed).

Table 2 displays the elasticity of wages relative to the net-of-tax rate according to the wage quintile in the earlier year. The estimation did not include taxpayers in the bottom quintile, because almost all of them were below the income tax threshold.[47] Furthermore, it is extremely difficult to control for the regression of wages to the mean among those earning low wages. As mentioned, for these reasons, we restricted the previous estimations to taxpayers whose wages were above a certain threshold, as has been done in many of the studies throughout the world. Small and insignificant negative elasticity was found in the second quintile, which is likely to be a result of the regression of wages to the mean.[48] In the highest quintile, elasticity is positive and large – approximately 0.4 in the highest decile – and the effect of income is not significant. We also estimated elasticity in groups of three deciles (1–3, 2–4,…, 7–9, 8–10), and the results (not displayed) are consistent with those described above.

Table 3 displays the elasticities obtained in non-weighted estimations including and not including the "virtual income" explanatory variable,[49] and also the elasticities obtained from the weighted estimations. We learn from Table 3A that elasticity increases to 0.07 when we restrict the estimations to individuals earning over NIS 40,000 a year. When we exclude the five highest percentiles, elasticity wanes slightly, because the behavioral response is stronger in the upper part of the wage distribution – a result also obtained in other studies in this field. The weighted estimations yielded higher elasticities and, as expected, the estimates are less sensitive to exclusion of those with low wages.

As is usual in this field, we have included in the estimations up until now a dummy explanatory variable for the gross annual wage decile in the earlier year in order to deal with regression of wages to the mean. We conducted a sensitivity analysis in which we

[47] The estimated elasticity obtained from the estimation that includes all of the taxpayers in the bottom quintile (in which the "virtual income" explanatory variable was included) is -0.6006, and is very significant. On the other hand, the estimated elasticity in the bottom three deciles, deciles that contain many wage earners above the tax threshold, is -0.079, and is not significant. We learn from this that there is a problem in restricting the estimation for the bottom quintile.

[48] The decrease in the marginal tax rate in the bottom part of the second quintile was less than the decrease in the upper part of it (see Appendix Fig. A-1), and the regression to the mean was stronger.

[49] In most of the studies, the estimations did not include the "virtual income" explanatory variable, and it therefore follows that they estimated the uncompensated elasticity of wage relative to the net-of-tax rate.

replaced the dummy variable for the wage decile with a continuous wage function, namely, a third-degree polynomial of the wage percentile. Estimates of the polynomial (not displayed) indicate that the phenomenon of regression to the mean is very strong in the bottom wage decile, gets weaker up until the third decile, and then disappears; it reappears in the two top deciles, but with less power than in the bottom deciles. The results obtained from the estimations based on the polynomial are displayed in Appendix Table A-3. They indicate that the elasticities are higher than those in Table 3A, and the difference is relatively small among taxpayers whose wages are greater than NIS 40,000 a year.

Measuring error in calculating the net-of-tax rate will make the estimates biased toward zero. In order to reduce this bias, we focused on taxpayers for whom the difference between the calculated tax liability and their actual tax liability was not greater than 10 percent in each of the years in the pair (Table 3B). This restriction decreases by approximately one third the number of taxpayer years in the various estimations. The table shows that, as expected, the estimated elasticities are higher than the estimates in Table 3A, and the weighted elasticities are 0.08. When we examine a difference that does not exceed 5 percent, the estimates increase, and the weighted elasticities reach about 0.12 (Appendix Table A-4).

Table 3C displays the results of the estimations based on the projected wages according to Equation (2).[50] These estimations were designed to neutralize the way regression of wages to the mean affects the principal explanatory variable: the change in the net-of-tax rate. The weighted elasticity estimates are higher than those displayed in Table 3A.

Table 4 examines the heterogeneity of the elasticity of wages relative to the net-of-tax rate according to the characteristics of taxpayers (whose wages are over NIS 40,000 a year) by adding (1) a variable for the interaction between a dummy variable for the taxpayer's characteristic (male, for example) and the net-of-tax rate, and (2) a variable for the interaction between the wage decile in the earlier year and the net-of-tax rate; The purpose is to control for the differences in response according to the level of wages.

[50] The results of the estimation predicting wages three years later can be obtained from the authors. Its explanatory power is high (adjusted $R^2 = 0.62$), and the estimates for the explanatory variables are in the expected direction.

There is no robust difference in elasticity for the following groups (in comparison with their own complements), all else equal: men, Jews, well-educated people, those whose family status did not change, and residents of the outlying areas. Note that Lehmann et al. (2013) and Kleven and Schultz (2014) found similar elasticities among men and women, while Blomquist and Selin (2010) and Matikka (forthcoming) found higher elasticities among women. Our study indicates that elasticity among young people is higher than elasticity among older people, all else equal.[51]

We conducted estimations for taxpayers who remained married to the same spouse in the pair of years, because changes in virtual income of a spouse resulting from the tax reform can have an income effect on the taxpayer; furthermore, the reform is likely to increase the labor supply of one member of the couple, thereby reducing the supply of the other member's labor (a cross-effect between spouses). We therefore included three explanatory variables for the spouse in the estimations: the change in the net-of-tax rate, the change in virtual income, and wages in the earlier year. The results, which are displayed in Appendix Table A-5, indicate that the inclusion of these variables made almost no difference in the elasticity estimates.

Appendix Table A-6 displays the results of the estimations for taxpayers in the public sector. It turns out that elasticity in the public sector is negative, very small, and sometimes not significant. This finding supports the decision to exclude taxpayers in the public sector from the study population.

We have hitherto treated 2002–2010 as a single block. Table 5 divides it into two sub-periods – (a) 2002–2005, and (b) 2006–2010 – for three reasons: first of all, the tax reform began in the first sub-period, and most of the cuts in tax rates took place during this period (see Figure 5 above); secondly, many and sharper divisions in the tax brackets were instituted in the first sub-period than in the second sub-period; thirdly, the employee-employer files changed from 2006 onward. The table shows that elasticity in

[51] While the estimations did not include a variable for the interaction between the wage decile in the earlier year and the net-of-tax rate, they sometimes yielded significant differences in elasticity between population groups. These findings indicate that the differences are a result of different locations on the wage probability distribution and the fact that elasticity varies according to wage level (regardless of the population group), as we showed in Table 2.

the earlier period was 0.09, while it is not significantly different from zero in the later period.

The tax benefits for communities were greatly reduced in 2002–2010, especially in the outlying areas (the northern and southern districts). Wage earners residing in them therefore benefited from less reduction in the effective marginal direct tax rate, compared with wage earners in the outlying areas who benefited only from the reform (for the first group the rate fell from 24.6 percent to 18.8 percent, while for the second group it fell from 32.2 percent to 21.3 percent). Appendix Table A-7 displays the results of the estimations of whether there were differences in elasticity between wage earners residing in beneficiary communities and the other wage earners in the outlying areas. No significant differences between the two sets of wage earners were found.

Finally, like most of the researchers in the field, we focused on the way that the taxpayers responded to the reform after three years. It is interesting, however, to examine their response after a shorter period. Appendix Table A-8 displays the elasticity estimates after one and two years. Elasticity after two years is greater than elasticity after one year, but is not always less than elasticity after three years (Table 3A above). It therefore follows that the estimations in the study – meaning after three years – reflect the full behavioral response to the tax reform.

Table 1 – Factors Explaining the Changes in Gross Wages, 2002–2010
(positive annual wages in the earlier and later years)

		Not Weighted		Weighted[1]		
		All	Annual Wages Greater than NIS 40,000	All	Annual Wages Greater than NIS 40,000	
					All	Excluding the Five Highest Percentiles
		(1)	(2)	(3)	(4)	(5)
The change in the net-of-tax rate (percentages)		0.034**	0.067***	0.067***	0.100***	0.055***
		(0.015)	(0.009)	(0.016)	(0.013)	(0.010)
The real change in virtual income (percentanges)		-0.331***	-0.056			
		(0.062)	(0.038)			
Male		0.150***	0.081***	0.093***	0.061***	0.067***
		(0.004)	(0.002)	(0.004)	(0.003)	(0.003)
Age (in years)		-0.002	-0.012***	-0.007**	-0.015***	-0.012***
		(0.003)	(0.001)	(0.003)	(0.002)	(0.002)
Age squared		-5.31e-05*	9.58e-05***	2.21e-05	1.29e-04***	9.40e-05***
		(2.91e-05)	(1.67e-05)	(3.11e-05)	(2.7e-05)	(1.98e-05)
Religion (relative to Jews or others)	Muslim	-0.169***	-0.083***	-0.151***	-0.072***	-0.078***
		(0.008)	(0.005)	(0.009)	(0.007)	(0.006)
	Christian Arab	-0.075***	-0.053***	-0.068***	-0.059***	-0.061***
		(0.015)	(0.008)	(0.015)	(0.014)	(0.011)
	Druze[2]	-0.181***	-0.049***	-0.115***	-0.042***	-0.043
		(0.021)	(0.011)	(0.019)	(0.013)	(0.013)
Level of education (relative to high school and lower)	post secondary non-academic	0.070***	0.036***	0.051***	0.035***	0.033***
		(0.005)	(0.002)	(0.005)	(0.004)	(0.003)
	Academic	0.164***	0.110***	0.117***	0.099***	0.095***
		(0.004)	(0.002)	(0.004)	(0.004)	(0.003)
	Yeshiva	-0.023	-0.035**	-0.030	-0.020	-0.026
		(0.023)	(0.014)	(0.026)	(0.022)	(0.017)
	Other education	0.075***	0.049***	0.080***	0.066***	0.042***
		(0.014)	(0.008)	(0.013)	(0.012)	(0.009)
Married (in the later year)		0.092***	0.015***	0.068***	0.024***	0.024***
		(0.005)	(0.003)	(0.005)	(0.004)	(0.003)
Change in family status to or from married between the earlier and later year		0.006	-0.008**	0.015**	-6.79e-05	2.91e-04
		(0.006)	(0.004)	(0.007)	(0.005)	(0.005)
Number of children under 18 (in the later year)		0.003*	0.003***	0.004**	0.004***	0.002**
		(0.002)	(0.001)	(0.002)	(0.001)	(0.001)
Number of children born in the later year		-0.107***	-0.048***	-0.067***	-0.040***	-0.047***
		(0.005)	(0.003)	(0.005)	(0.005)	(0.004)
Number of children born in the earlier year		0.027***	0.035***	0.028***	0.025***	0.027***
		(0.005)	(0.003)	(0.005)	(0.004)	(0.003)
Number of children born between the earlier and later years		-0.079***	-0.016***	-0.039***	-0.013***	-0.014***
		(0.005)	(0.003)	(0.005)	(0.004)	(0.003)
Wage decile in the earlier year (dummy variable)		V	V	V	V	V
Real change in wages between the earlier year and the year before it (percentages)		-0.006***	0.008***	-0.001	0.004***	0.007***
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Real change in wages between the year before the earlier year and the year before that year (percentages)		-0.011***	0.001**	-0.006***	4.51e-05	3.53e-04
		(0.001)	(3.58e-04)	(0.001)	(0.001)	(4.52e-04)
Real change in child allowances given for children in the earlier year (percentages)		-0.015	-0.082***	-0.069***	-0.091***	-0.081***
		(0.014)	(0.007)	(0.014)	(0.011)	(0.009)
Year (dummy variable for the earlier year)		V	V	V	V	V
Economic sector[3] (dummy variable)		V	V	V	V	V
Residential district (dummy variable)		V	V	V	V	V
Number of observations		299,775	198,066	299,775	198,066	188,751
Adjusted R^2		0.195	0.146	0.064	0.133	0.110

Source: Israel Tax Authority – employee-employer files; Central Bureau of Statistics – Labor Force Surveys and Population Registry; and analyses by the authors.
*, **,*** Significant at a level of 10 percent, 5 percent, and 1 percent, respectively. The standard deviations (clustered by taxpayer) are displayed in parentheses.
(1) According to the gross wage in the earlier year.
(2) Including Circassians.
(3) The following is the division into economic branches in the business sector (according to the uniform classification of the economic branches, 1993): agriculture (0); traditional industries (10–29, 36–39); advanced industries (30–35); electricity and water (40–41); construction (45–46); wholesale and retail trade (50–53); hosting and food services (55–56); transportation, storage, and mail (60–65); communications (66); banking, insurance, and other financial institutions (67–68); computer and R&D services (72–73); immovable assets and other business services (70, 71, 74, 75, 76); "private" community and social services and other personal services (94–97); foreign organizations and entities (99).

Table 2 – Elasticity of Gross Annual Wages Relative to the Net-of-Tax Rate and to Virtual Income, by Wage Quintiles in the Earlier Year

(positive wages in the earlier and later year; not weighted)

	Wage Quintile in the Earlier Year[1]				Decile
	2	3	4	5[2]	10[2]
A. With Virtual Income					
Net-of-tax rate	-0.042	-0.016	0.107***	0.314***	0.416***
	(0.030)	(0.032)	(0.029)	(0.045)	(0.055)
Virtual income	-0.757***	-0.756***	-0.637***	0.083	0.295
	(0.215)	(0.135)	(0.109)	(0.114)	(0.182)
B. Without Virtual Income					
Net-of-tax rate	-0.086***	-0.089***	0.057**	0.328***	0.443***
	(0.028)	(0.030)	(0.028)	(0.041)	(0.052)

Source: Israel Tax Authority – employee-employer files; Central Bureau of Statistics – Labor Force Surveys and Population Registry; and analyses by the authors.
*, **,*** Significant at a level of 10 percent, 5 percent, and 1 percent, respectively. The standard deviations (clustered by taxpayer) are displayed in parentheses. All of the estimations include the explanatory variables appearing in Table 1.
(1) The bottom quintile is not displayed in the table, because only 0.7 percent of the taxpayers in it were above the tax threshold. It is therefore difficult to discern how the tax reform affects their wages.
(2) Without the top three thousandths.

Table 3 – Elasticity of Gross Annual Wages Relative to the Net-of-Tax Rate with Various Restrictions on Wages

A. Income in the Later Year Equals Income in the Earlier Year in constant Prices

		Positive Wage	Greater than NIS 40,000	
			All	Excluding the Five Upper Percentiles
Not weighted	With virtual income	0.034*** (0.015)	0.067*** (0.009)	0.064*** (0.009)
	Without virtual income	0.000 (0.014)	0.061*** (0.008)	0.037*** (0.008)
Weighted[1]		0.067*** (0.016)	0.100*** (0.013)	0.055*** (0.010)

B. Income in the Later Year Equals Income in the Earlier Year in constant Prices and the Difference between the Calculated Tax Liability and the Actual Tax Liability Does Not Exceed 10 Percent in the Two Years

		Positive Wage	Greater than NIS 40,000	
			All	Excluding the Five Upper Percentiles
Not weighted	With virtual income	0.011 (0.020)	0.070*** (0.011)	0.069*** (0.011)
	Without virtual income	0.030 (0.019)	0.102*** (0.011)	0.071*** (0.011)
Weighted[1]		0.083*** (0.018)	0.119*** (0.016)	0.067*** (0.013)

C. Projected Income in the Later Year

		Positive Wage	Greater than NIS 40,000	
			All	Excluding the Five Upper Percentiles
Not weighted	With virtual income	-0.060*** (0.017)	0.041*** (0.009)	0.055*** (0.009)
	Without virtual income	-0.003 (0.015)	0.070*** (0.009)	0.048*** (0.008)
Weighted[1]		0.072*** (0.017)	0.106*** (0.014)	0.069*** (0.010)

Source: Israel Tax Authority – employee-employer files; Central Bureau of Statistics – Labor Force Surveys and Population Registry; and analyses by the authors.

*, **,*** Significant at a level of 10 percent, 5 percent, and 1 percent, respectively. The standard deviations (clustered by taxpayer) are displayed in parentheses. All of the estimations include the explanatory variables appearing in Table 1.

(1) Weighted according to wages in the earlier year.

Table 4 – Elasticity of Gross Annual Wages Relative to the Net-of-Tax Rate, according to the Wage Earners' Characteristics

(annual wages higher than NIS 40,000 in the earlier and later years,

weighted according to wage in the earlier year)

Group (1):	Men	Young People[1]	Jews	Educated People[2]	With no Change in Family Status[3]	Outlying Areas[4]
Complementary Group (2):	Women	Older People[1]	Arabs	Uneducated People	A Change in Family Status	Center
Net-of-tax rate x Group (1)	0.015 (0.029)	0.051* (0.027)	0.036 (0.089)	0.036 (0.029)	-0.040 (0.062)	-0.018 (0.029)
Number of observations	198,066	198,066	198,066	198,066	198,066	198,066
Adjusted R^2	0.135	0.135	0.135	0.135	0.135	0.135

Source: Israel Tax Authority – employee-employer files; Central Bureau of Statistics – Labor Force Surveys and Population Registry; and analyses by the authors.

*, **,*** Significant at a level of 10 percent, 5 percent, and 1 percent, respectively. The standard deviations (clustered by taxpayer) are displayed in parentheses. All of the estimations include the explanatory variables appearing in Table 1, except for virtual income. All of the estimations also include the explanatory variable "wage decile X net-of-tax rate."

(1) Young people: age 30–39; older people: men age 40–59 and women age 40–54.

(2) Educated people: last school – an institution that grants an academic degree.

(3) Family status did not change between the earlier and later years.

(4) Outlying areas: northern and southern districts.

Table 5 – Elasticity of Gross Annual Wages Relative to Net-of-Tax Rate, by Period

(positive wages in the earlier and later years; difference between the calculated tax liability and the actual tax liability does not exceed 10 percent in the two years;

weighted according to the wage in the earlier year)

	2005–2002 (the later year)	2006–2007 (the earlier year)
Net-of-tax rate	0.087*** (0.028)	-0.017 (0.064)
Number of observations	109,611	76,014
Adjusted R^2	0.065	0.062

Source: Israel Tax Authority – employee-employer files; Central Bureau of Statistics – Labor Force Surveys and Population Registry; and analyses by the authors.

*, **,*** Significant at a level of 10 percent, 5 percent, and 1 percent, respectively. The standard deviations (clustered by taxpayer) are displayed in parentheses. All of the estimations include the explanatory variables appearing in Table 1, except for virtual income.

G. Summary

The question of how the direct tax rate affects the incentive to work has received considerable attention in the economics literature and in public discourse. Cutting the rate is likely to stimulate a range of responses among individuals: among other things, they are likely to work more hours, carry out their tasks more diligently, acquire more human capital, and reduce tax evasion, all of which are reflected in the reported gross income from labor.

Major tax reforms are rarely undertaken, and provide a convenient opportunity to estimate how direct taxation affects behavior. Our study takes advantage of this opportunity: it examines the reform undertaken in Israel in 2003–2009, which cut direct taxation of individuals by 7–17 percentage points. Since this was a large-scale and differential cut that was not correlated with income, it is possible to identify its effect and isolate it from other shocks and from long-term trends.

The database relied on the Israel Tax Authority's files of wage earners, which contain multi-year (panel) information on wages and tax payments. We paired these files with Labor Force Surveys carried out by the Central Bureau of Statistics for 2001–2010; these surveys are based on a representative sample of residents of working age, and include their demographic, social, and economic characteristics.

In conformity with the usual practice in the literature, we estimated the real change that occurred in gross reported wages between each pair of years separated by three years as a function of the change in the net-of-tax rate (one minus the effective marginal direct tax rate), the real change in virtual income, the constant and variable demographic, social, and economic characteristics of the taxpayer, and his wages in the earlier year and the years preceding it, as well as dummy variable for years.

Like other researchers, we dealt with the problem of the endogeneity of wages and income tax rates by applying the tax function of the later year to the wages in the earlier year, inflated according to the Consumer Price Index (in contrast to the actual wages in the later year). We also dealt with two methodological problems that have not been properly addressed in the research literature. The first was that measuring error in calculating the marginal tax rate makes the estimation results biased toward zero. In order

to deal with the problem, we conducted sensitivity tests that excluded wage earners whose calculated tax liability (according to the model we devised) deviated by more than 10 percent (or more than 5 percent) from their liability according to the Israel Tax Authority. The second was that the marginal tax rate is determined according to wages, and is therefore exposed to bias caused by the regression of wages to the mean. In order to deal with this problem, we conducted a two-stage estimation: we first estimated an individual's wages according to his personal characteristics and past wages, because the projected wages are not sensitive to regression to the mean. In the second stage we included in the main estimation the marginal tax rate derived from the projected wages, since this rate is not biased.

Our findings show that in the business sector, the elasticity of gross annual reported wages relative to the net-of-tax rate is approximately 0.1; this value is within the range of elasticities found in similar studies in Western countries. The cut in the marginal tax rate on income from labor did not affect the behavior of individuals belonging to the three lowest wage quintiles, a population group that is mostly below the tax threshold, but it affected the individuals belonging to the two highest quintiles: elasticity increased with wages – from approximately 0.1 in the fourth quintile to approximately 0.3 in the top quintile and to approximately 0.4 in the top decile. For this reason, the weighted elasticity according to wages, approximately 0.1, is greater than the non-weighted elasticity – 0.03–0.06. The effect of the reform on the reported wages almost accomplished after two years, and stabilized after three years. There were no robust differences in the estimated elasticities for the following groups (compared to their complements): men, Jews, and well-educated people. The estimations that focused on the public sector did not find that its employees responded to the tax reform.

Estimation of the weighted elasticity makes it possible to estimate how the tax reform contributes to increasing total wage payments in the economy: in 2002–2009, the marginal direct tax rate fell by approximately 9 percentage points, and the net-of-tax rate rose by approximately 13 percent; according to the estimated weighted elasticity (0.083; see Table 3B), the rise in the net-of-tax rate increased total gross reported wages in the business sector by approximately 1.1 percent (13*0.083). About half of the increase resulted from an increase in wages among the five top percentiles, a population group

having the ability to maneuver between wages and income from capital. Assuming an absence of this type of maneuvering, and assuming that the capital stock adjusted itself, it can be calculated that the tax reform increased business product by 1.1 percent. If the wages of the top five percentiles rose as a result of the displacement of income from capital to wages, however, then the reform contributed much less to increasing output. On the other hand, cutting the tax rates is likely to contribute to output in channels that we did not examine in this study – by increasing the participation rate and the accumulation of human capital.

The study has several drawbacks that are liable to make the estimates of the elasticity of wages relative to the net-of-tax rate biased. It relied on the tax function that we calculated, but this function does not completely imitate the function applied by the Israel Tax Authority and the National Insurance Institute, because of a lack of information, particularly as concerns the tax benefits for provisions from wages for pension funds, provident funds, and advanced training funds, but also for tax coordination. There is also no way to detect income maneuvering between different sources (between wages and capital, for example), and this phenomenon is more frequent in the upper deciles – a population group among which the elasticity of wages relative to the net-of-tax rate is relatively high. Finally, it should be noted that the elasticities estimated here are based on cuts in the tax rates, and it is possible that raising the rates yields different elasticities.

In the future, it will be possible to test the direct effect of the tax reform on the labor supply in terms of work hours with the help of the short-term panel in the Labor Force Surveys. In this way, a bottom estimate will be obtained for the effect that is not connected to tax evasion, effort at work, etc.

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Appendices

Table A-1 – Outline of Reducing Income Tax Rates according to the Recommendations Published by the Committee for Tax Reform in 2002

Brackets (in monthly NIS in 2002 prices)	The Proportion of the Average Monthly Wage in the Economy in 2002 (percentages)	Income Tax Rates (percentages)				The Change in Income Tax Rates (percentage points)
		2002	2003	2005	2008	2008 compared with 2002
0-1,970	0-28	10	10	10	10	0
1,971-3,950	28-56	20	19	19	17	-3
3,951-4,900	56-70	30	26	26	26	-4
4,901-10,400	70-148	30	28	27	26	-4
10,401-10,590	148-151	45	28	27	26	-19
10,591-18,840	151-268	45	45	41	34	-11
18,841-30,000	268-427	50	50	47	37	-13
30,001-34,820	427-496	50	50	47	39	-11
Over 34,821	Over 496	50	50	50	49	-1

Source: Income Tax Reform: Recommendations of the Committee for Tax Reform, Table 4; Central Bureau of Statistics; and analyses by the authors.

Table A-2 – Characteristics of the Study Population by Gender, Average in 1998–2010

		Average			Standard Deviation		
		All	Men	Women	All	Men	Women
Men[1] (rate, percentages)		61.0			48.8		
Age (years)		42.1	42.9	40.8	8.2	8.6	7.3
Jews and others[1] (rate, percentages)		88.6	86.5	91.9	31.7	34.2	27.2
Well-educated[1, 2] (rate, percentages)		29.9	29.7	30.1	45.8	45.7	45.9
Married[3] (rate, percentages)		79.6	83.6	73.1	40.3	37.0	44.3
Number of children[4] (under 18)		1.55	1.56	1.52	1.49	1.53	1.44
Employment rate (percentages)		77.9	80.2	74.3	41.5	39.8	43.7
Yearly wages[5] (NIS, 2010 prices)		135,810	162,577	91,010	208,785	249,323	96,455
Distribution of economic branches[6] (percentages)	Agriculture	2.2	2.3	2.0			
	Traditional industries	10.9	14.3	7.3			
	Advanced industries	4.0	5.7	2.2			
	Electricity and water	0.8	1.3	0.3			
	Construction	5.4	8.9	1.6			
	Wholesale and retail trade	12.9	14.5	11.2			
	Hosting and food services	2.7	2.9	2.4			
	Transportation, storage, and mail	4.5	6.3	2.6			
	Communications	1.0	1.2	0.8			
	Banking, insurance, and other financial institutions	3.6	2.8	4.5			
	Computer services and R&D	4.3	5.6	2.9			
	Immovable assets and miscellaneous business services	13.2	14.9	11.5			
	"Private" community and social services and miscellaneous personal services	1.9	1.8	2.6			
	Foreign organizations and state agencies	0.0	0.0	0.0			
	Public sector	32.6	17.5	48.1			
Distribution of residential district (percentages)	Jerusalem	6.5					
	North	16.9					
	Haifa	12.8					
	Center	27.2					
	Tel Aviv	19.6					
	South	13.6					
	Judea and Samaria	3.4					

Source: Israel Tax Authority – employee-employer files; Central Bureau of Statistics – Labor Force Surveys and Population Registry; and analyses by the authors.

(1) Based on the Labor Force Surveys. The other explanatory variables rely on the employee-employer files and the Population Registry.

(2) The most recent school or academic institution.

(3) The proportion calculated among taxpayers whose family status is known.

(4) Employees during at least one month of the year (this definition is equivalent to a positive wage during the year).

(5) Those who had a positive wage during the year.

(6) The following is the division into economic branches in the business sector (according to the uniform classification of the economic branches, 1993): agriculture (0); traditional industries (10–29, 36–39); advanced industries (30–35); electricity and water (40–41); construction (45–46); wholesale and retail trade (50–53); restaurant and food services (55–56); transportation, storage, and mail (60–65); communications (66); banking, insurance, and other financial institutions (67–68); computer and R&D services (72–73); immovable assets and other business services (70, 71, 74, 75, 76); "private" community and social services and other personal services (94–97); foreign organizations and entities (99). The public sector: public administration (77–79), education (80); health services (85), welfare and nursing services (86), "public" community and social services (90–93).

Table A-3 – Elasticity of Gross Annual Wages Relative to the Net-of-Tax Rate

Replacement of the Explanatory Dummy Variable for the Wage Decile by a 3rd-Degree Polynomial of the Wage Percentile

		Positive Wage	Greater than NIS 40,000	
			All	Excluding the Upper Five Percentiles
Not weighted	With virtual income	0.100*** (0.015)	0.068*** (0.009)	0.052*** (0.009)
	Without virtual income	0.121*** (0.014)	0.072*** (0.008)	0.031*** (0.008)
Weighted[1]		0.100*** (0.016)	0.157*** (0.014)	0.054*** (0.010)

Source: Israel Tax Authority – employee-employer files; Central Bureau of Statistics – Labor Force Surveys and Population Registry; and analyses by the authors.

*, **,*** Significant at a level of 10 percent, 5 percent, and 1 percent, respectively. The standard deviations (cluster by taxpayer) are displayed in parentheses. All of the estimations include the explanatory variables appearing in Table 1, but the dummy variable for the gross annual wage decile in the earlier year is replaced by a 3rd-degree polynomial of the gross annual wage in the earlier year.

(1) Weighted according to the wage in the earlier year.

Table A-4 – Elasticity of Gross Annual Wages Relative to the Net-of-Tax Rate

The Difference between the Calculated Tax Liability and the Actual Liability Does Not Exceed 5 Percent in the Pair of Years

		Positive Wage	Greater than NIS 40,000	
			All	Excluding the Highest Five Percentiles
Not weighted	With virtual income	-0.008	0.069***	0.067**
		(0.031)	(0.016)	(0.017)
	Without virtual income	0.043	0.144***	0.090***
		(0.028)	(0.015)	(0.016)
Weighted[1]		0.125***	0.176***	0.097***
		(0.025)	(0.021)	(0.019)

Source: Israel Tax Authority – employee-employer files; Central Bureau of Statistics – Labor Force Surveys and Population Registry; and analyses by the authors.

*, **,*** Significant at a level of 10 percent, 5 percent, and 1 percent, respectively. The standard deviations (clustered by taxpayer) are displayed in parentheses. All of the estimations include the explanatory variables appearing in Table 1.

(1) Weighted according to the wage in the earlier year.

Table A-5 – Elasticity of Gross Annual Wages Relative to the Net-of-Tax Rate by Marital Status

Annual Wage above NIS 40,000 in the Earlier and Later Years

		All	Married[1]	
			Without Spouse Variables	With Spouse Variables[2]
Non-weighted	With virtual income	0.067*** (0.009)	0.062*** (0.012)	0.062*** (0.012)
	Without virtual income	0.061*** (0.008)	0.056*** (0.012)	0.054*** (0.012)
Weighted[3]		0.100*** (0.013)	0.088*** (0.019)	0.086*** (0.019)

Source: Israel Tax Authority – employee-employer files; Central Bureau of Statistics – Labor Force Surveys and Population Registry; and analyses by the authors.

*, **,*** Significant at a level of 10 percent, 5 percent, and 1 percent, respectively. The standard deviations (clustered by taxpayer) are displayed in parentheses. All of the estimations include the explanatory variables appearing in Table 1.

(1) Taxpayers married to the same spouse in the earlier and later years, and the spouse appears in the employee files.

(2) The explanatory variables for the spouse were added to the estimation: the change in the net-of-tax rate, the change in virtual income, and wages in the earlier year.

(3) Weighted according to the wage in the earlier year.

Table A-6 – Elasticity of Gross Annual Wages Relative to Net-of-Tax Rate by Sector[1]

(Positive Annual Gross Wages in the Earlier and Later Years)

		All[2]	Business Sector	Public Sector[3]
Non-weighted	With virtual income	0.016	0.039**	-0.030*
		(0.012)	(0.015)	(0.017)
	Without virtual income	-0.011	0.004	-0.040**
		(0.011)	(0.014)	(0.016)
Weighted[4]		0.066***	0.072***	-0.009
		(0.013)	(0.016)	(0.018)

Source: Israel Tax Authority – employee-employer files; Central Bureau of Statistics – Labor Force Surveys and Population Registry; and analyses by the authors.

*, **,*** Significant at a level of 10 percent, 5 percent, and 1 percent, respectively. The standard deviations (clustered by taxpayer) are displayed in parentheses. All of the estimations include the explanatory variables appearing in Table 1.

(1) The dummy variables for the deciles are based on the wage deciles of wage earners in the business and public sectors together.
The results for the business sector are very similar to the results in Table 3 (the positive wage columns), but are not identical to them, because the deciles there are based only on the business sector.

(2) In the estimations that include a dummy variable for the public sector.

(3) The main branches included in the public sector (according to the uniform classification of the economic branches, 1993): public administration (77–79), education (80), health services (85), welfare and nursing services (86), and "public" community and social services (90–93).

(4) Weighted according to the wage in the earlier year.

Table A-7 – Elasticity of Gross Annual Wages Relative to Net-of-Tax Rate in the Outlying Areas, by Eligibility of the Community for a Tax Benefit[1]

(Positive Wages in the Earlier and Later Years, Non-Weighted)

A. General Estimations[2]

	Positive Wages	Over NIS 40,000
Entitled community X the net-of-tax rate	-0.094 (0.060)	-0.051 (0.033)
Number of observations	72,514	41,514
Adjusted R^2	0.210	0.119

B. Estimations with Interactions According to Quintiles[3]

		Positive Wages	Over NIS 40,000
[Entitled community X net-of-tax rate] X	Quintile 1	0.105 (0.593)	0.033 (0.049)
	Quintile 2	-0.016 (0.102)	0.064 (0.069)
	Quintile 3	-0.178 (0.114)	-0.112 (0.071)
	Quintile 4	-0.117 (0.110)	-0.200** (0.098)
	Quintile 5	-0.196 (0.128)	-0.159 (0.109)
Number of observations		72,514	41,869
Adjusted R^2		0.210	0.119

Source: Israel Tax Authority – employee-employer files; Central Bureau of Statistics – Labor Force Surveys and Population Registry; and analyses by the authors.

*, **,*** Significant at a level of 10 percent, 5 percent, and 1 percent, respectively. The standard deviations (clustered by taxpayer) are displayed in parentheses. All of the estimations include the explanatory variables appearing in Table 1, except for virtual income.

(1) Outlying areas – northern and southern districts. Eligible community – its residents were entitled to a tax benefit for at least one year during the study period.

(2) All the estimations also include the following explanatory variables: a dummy variable for an entitled community and the wage quintile X the net-of-tax rate.

(3) All the estimations also include the following explanatory variables: a dummy variable for an entitled community, entitled community X the wage quintile, and the wage quintile X the net-of-tax rate.

Table A-8 – Elasticity of Gross Annual Wages Relative to the Net-of-Tax Rate, by the Period of Time between the Earlier and Later Years

A. One Year

		Positive Wages	Over NIS 40,000	
			All	Excluding the Five Top Percentiles
Non-weighted	With virtual income	0.027***	0.057***	0.060***
		(0.015)	(0.008)	(0.008)
	Without virtual income	0.005	0.043***	0.037***
		(0.014)	(0.008)	(0.008)
Weighted[1]		0.010***	0.039***	0.036***
		(0.015)	(0.013)	(0.009)

B. Two Years

		Positive Wages	Over NIS 40,000	
			All	Excluding the Five Upper Percentiles
Non-weighted	With virtual income	0.037**	0.067***	0.069***
		(0.015)	(0.008)	(0.008)
	Without virtual income	0.022	0.056***	0.044***
		(0.014)	(0.008)	(0.008)
Weighted[1]		0.041***	0.073***	0.059***
		(0.016)	(0.013)	(0.009)

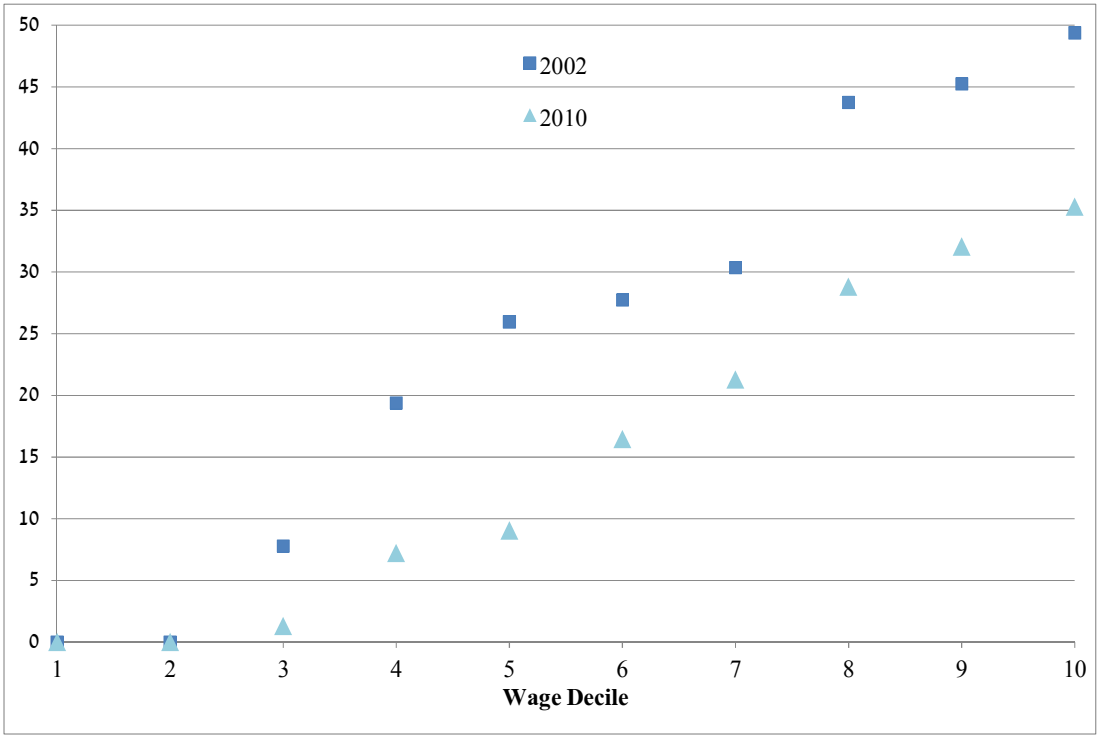
Source: Israel Tax Authority – employee-employer files; Central Bureau of Statistics – Labor Force Surveys and Population Registry; and analyses by the authors.

*, **,*** Significant at a level of 10 percent, 5 percent, and 1 percent, respectively. The standard deviations (clustered by taxpayer) are displayed in parentheses. All of the estimations include the explanatory variables appearing in Table 1.

(1) Weighted according to the wage in the earlier year.

Figure A-1 – Effective Marginal Income Tax Rates[1] by Wage Decile, 2002 and 2010

(percentages)



Source: Israel Tax Authority, Central Bureau of Statistics, and analyses by the authors.
(1) Applying to taxable income (at the ordinary tax rates) of taxpayers belonging to the study population, not including wage earners in the top three thousandths.

The Upper Bound of the Wage Decile (thousands of NIS, in current prices)

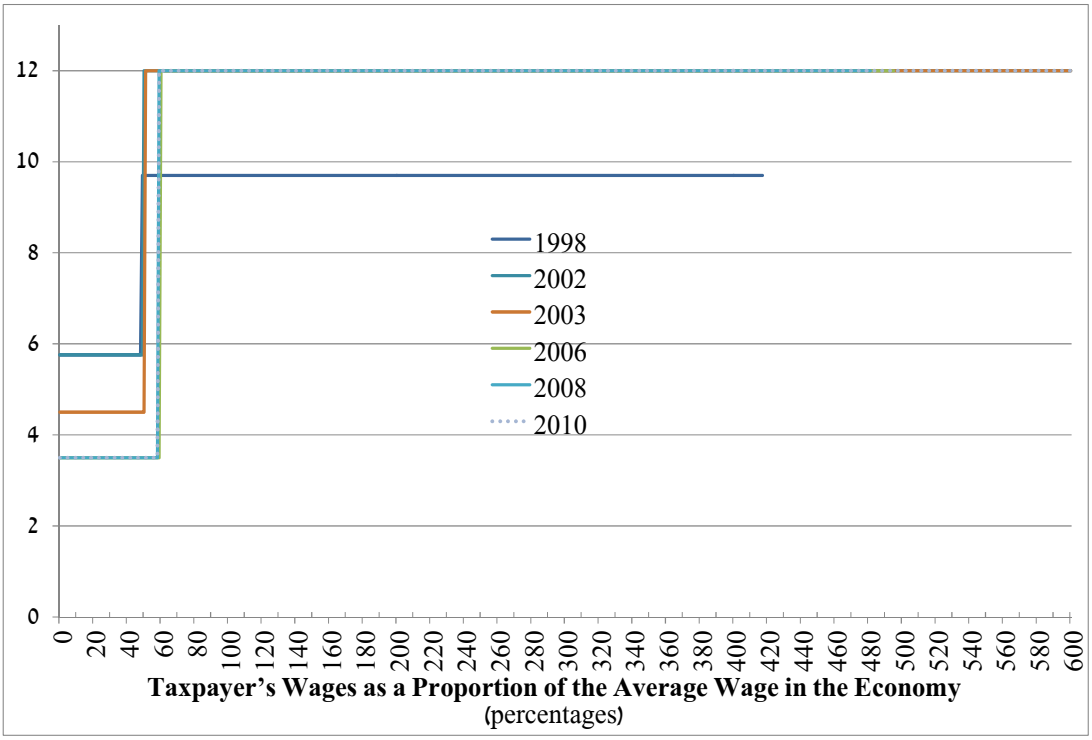
and its Value Relative to the Average Wage (percentages)

Year	Unit of Measure		Wage Decile									
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**Per-centiles 91-95**
2002	NIS (000)	Current Prices	16.2	33.5	47.6	61.5	78.9	100.6	129.7	172.7	246.3	325.9
		2010 prices	18.7	38.8	55.1	71.1	90.9	116.4	150.1	199.8	284.9	377.0
	Percentages		19.2	39.8	56.5	72.9	93.2	119.4	129.7	172.7	246.3	386.7
2010	NIS (000)		22.6	44.0	59.9	76.1	95.1	120.2	150.1	199.8	284.9	373.9
	Percentages		22.8	44.4	60.5	76.9	96.1	121.4	154.0	204.9	292.3	377.8

Source: Israel Tax Authority, Central Bureau of Statistics, and analyses by the authors.
Taxpayers belonging to the study population. Does not include wage earners in the three top thousandths.

Figure A-2 – National Insurance Institute Fees and Health Tax Rates[1], 1998–2010[2]

(percentages)



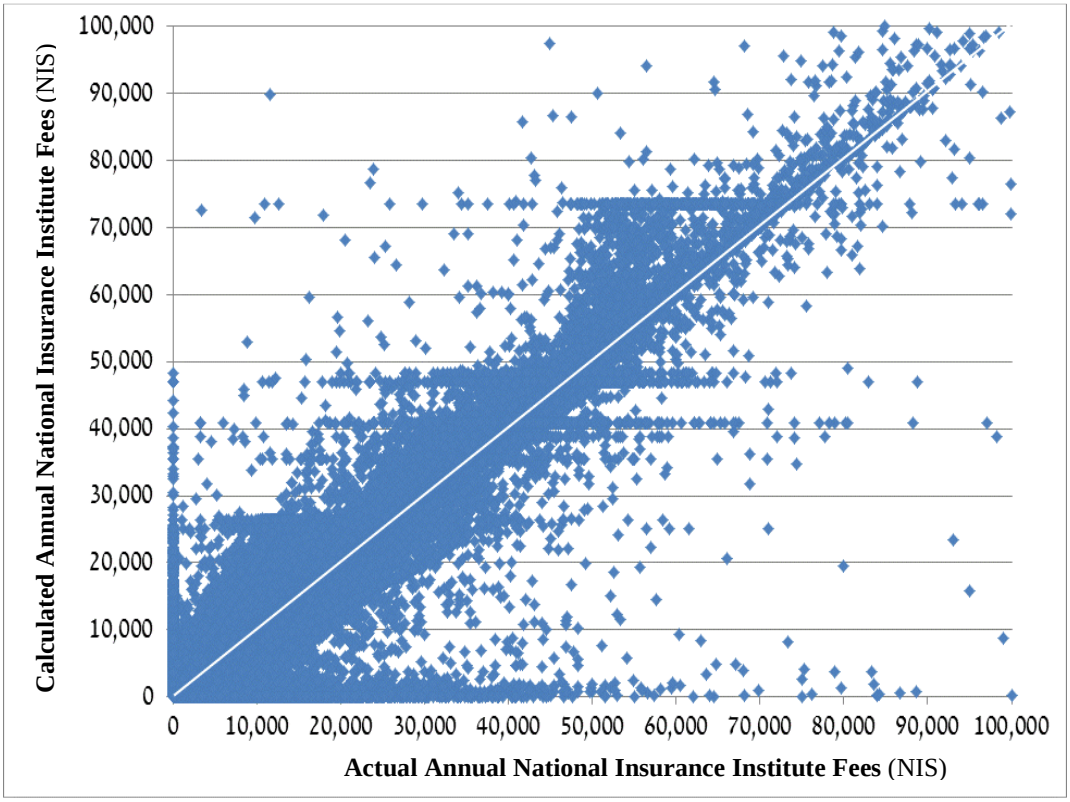
Source: Israel Tax Authority, Central Bureau of Statistics, and analyses by the authors.

(1) The rates applying to wage earners whose ages vary between 18 and retirement age.

(2) Between July 2002 and June 2003, the ceiling on income subject to National Insurance Institute fees was canceled, and the diagram reflects this. In August 2008, the ceiling was raised to 10 times the average wage.

Figure A-3 – The Calculated Liability for National Insurance Institute Fees[1] Applying to Wage Earners in Comparison with the Actual Liability[2], 1998–2010

(thousands of NIS in 2010 prices)



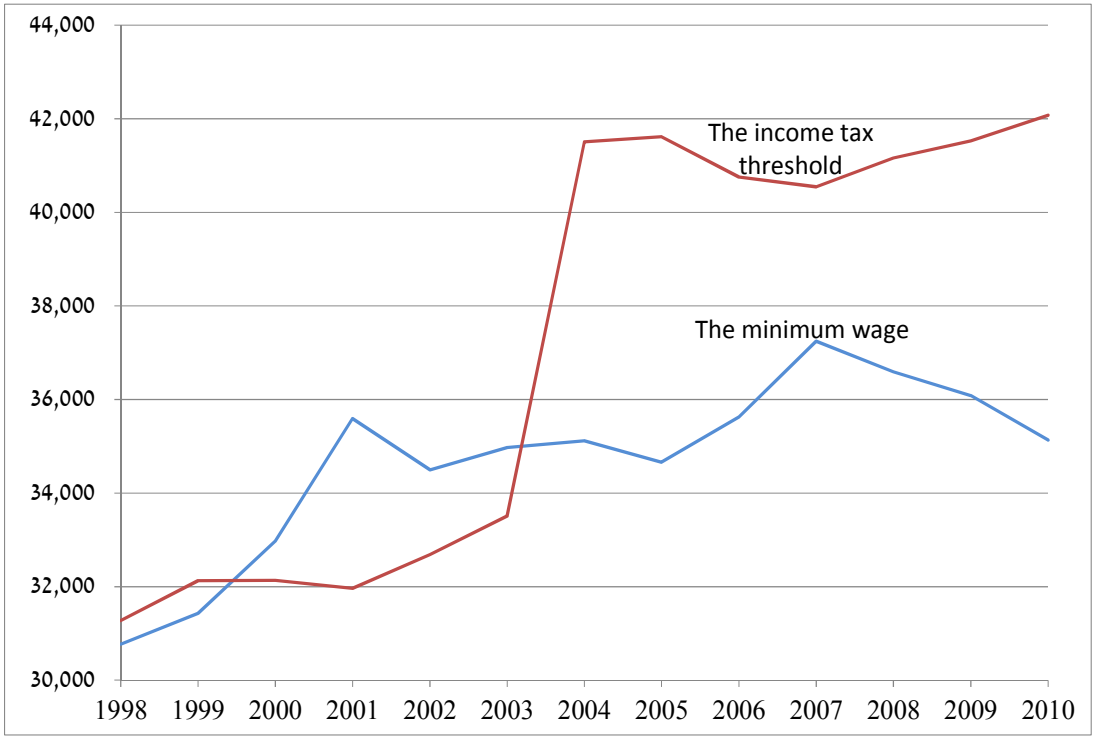
Source: Israel Tax Authority – employee-employer files; Central Bureau of Statistics – Labor Force Surveys and Population Registry; and analyses by the authors.

(1) Including health tax.

(2) Taxpayers belonging to the study population. Every point in the diagram represents one or more taxpayers.

Figure A-4 – The Minimum Wage[1] and the Income Tax Threshold[2], 1998–2010

(NIS per year in constant 1998 prices)

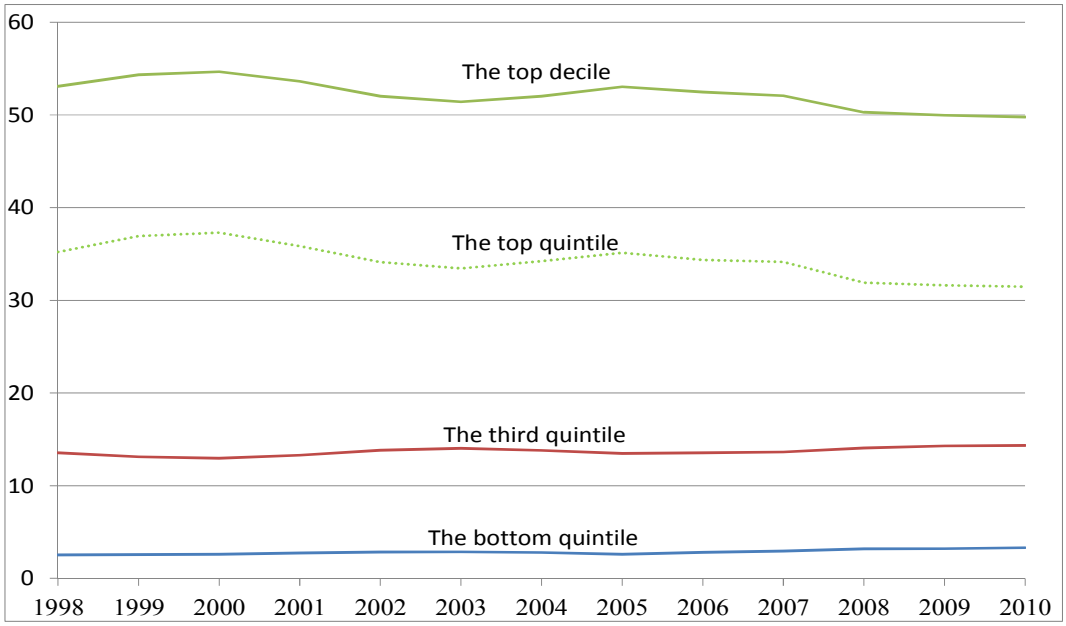


Source: National Insurance Institute, Israel Tax Authority; Central Bureau of Statistics, and analyses by the authors.

(1) The minimum wage for an employee (over 18) working full time.

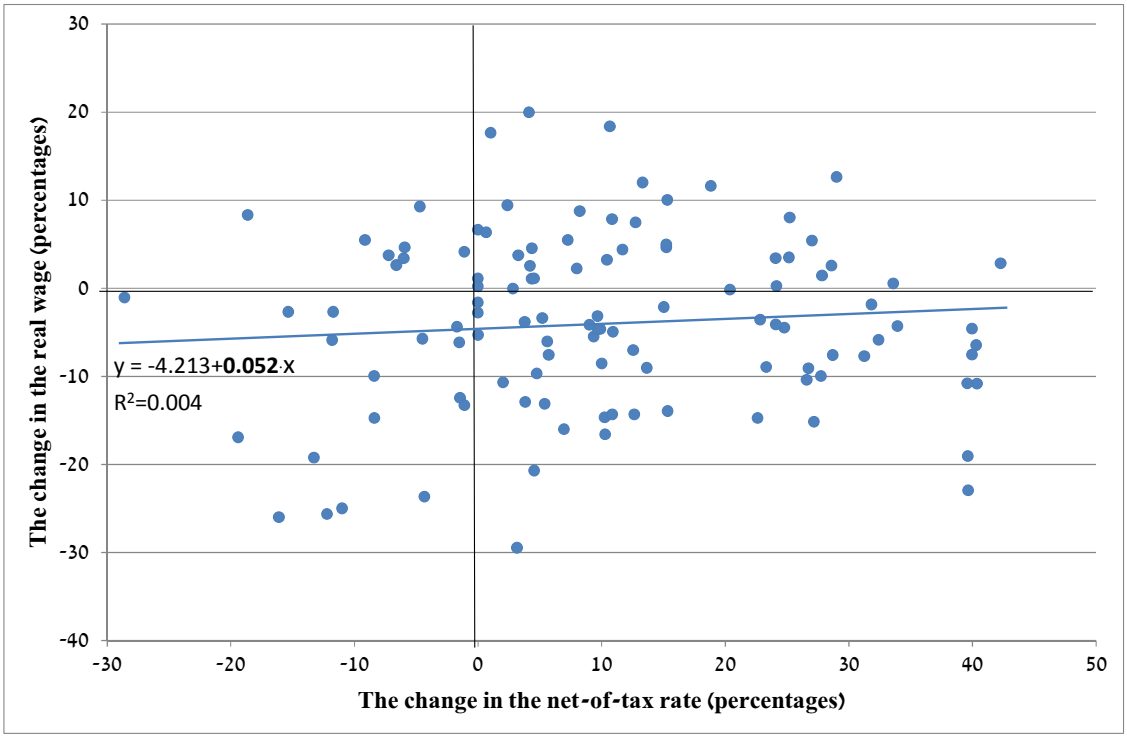
(2) For a wage earner entitled to a minimum number of credit points – 2.25 (for residency and travel to work). Taxpayers who lived in communities that benefited from a tax credit, or who received a tax credit for shift work, were not included in the calculation.

Figure A-5 – The Share of Selected Quintiles in Gross Annual Reported Wages[1], 1998–2010 (percentages)



Source: Israel Tax Authority – employee-employer files; and analyses by the authors.
(1) From all jobs held by the taxpayer. Taxpayers belonging to the study population (including taxpayers in the top three thousandths).

Figure A-6 – The Average Change[1] in Real Wages as a Function of the Change in the Net-of-Tax Rate[2]: The Later Year Compared with the Earlier Year



Source: Israel Tax Authority, Central Bureau of Statistics, and analyses by the authors.

(1) Every point in the diagram reflects the averages of the change in the net-of-tax rate and the real wage of a group of taxpayers who were subject to the same effective marginal income tax rate in the earlier year and also an identical effective marginal income tax rate in the later year (separately for each earlier year); see, for example, the selected years in Figure 3. The regression line is based on estimations weighted according to the number of taxpayers in each group.

(2) Taxpayers belonging to the study population. We restricted the diagram to taxpayers whose effective marginal income tax rates in the earlier and later years were consistent with the statutory tax rates, and we excluded the wage earners found to be below the tax threshold in the earlier year, or who lived in communities that benefited from a tax credit, or who received a tax credit for shift work.