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"The Effects of Income Tax Cuts on Emigration from Israel"

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ABSTRACT

Both the theoretical and empirical literatures indicate that income tax cuts may have a significant impact on migration flows. Nonetheless, there is a paucity of empirical studies that systematically examine the effect of a general (as opposed to an ad-hoc) and permanent income tax reduction on migration patterns. During the period 2004-2010 Israel implemented a substantial income tax cut that was partially offset two years later, while statutory tax rates remained in a permanent lower level. In this paper we build a framework for analyzing the effect of permanent income tax reductions on emigration and we perform an empirical analysis of their impact. Our analysis considers the alternative net wage that these potential migrants may earn in destinations countries. We find that permanent tax reductions reduce the emigration flows from Israel. According to our findings, this effect is stronger for workers in the low tech sector than for their high tech counterparts, as the former are more sensitive to changes in net wages.

Key Words: Permanent Tax Cut, Emigration.

JEL Classification Numbers: H20, J38, J61

1. Introduction

A well-established theoretical and empirical finding in Public Economics is that high-income earners strongly respond to income taxation (Gruber and Saez, 2002). The literature stresses migration as one of the channels of response (Slemrod, Saez and Giertz, 2012). Two recent empirical studies of Kleven, Landais and Saez (2013) and Kleven, Landais, Saez and Schultz (2014) found that migration decisions were significantly affected by tax incentives, indicating that the migration margin must be considered when designing the optimal tax-and-transfer system.

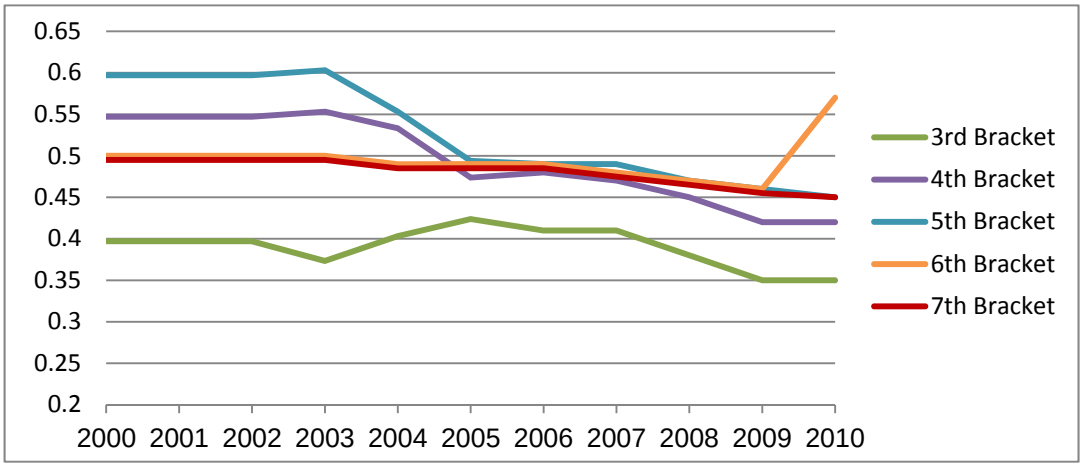
In light of the growing earnings inequality in Israel, suggestions to increase the top marginal tax rates are widely discussed by policymakers and in academic circles. We argue that the effectiveness of such reforms depends to a large extent on the migration opportunities available to high-income earners. We conjecture that within the pool of high-income earners, there is much variation in overseas employment prospects. This implies that increasing marginal tax rates should be done with awareness to its potential effects on migration, taking into account the variation in migration elasticities.

In the period 2004-2010, the Israeli Government implemented a substantial and consistent gradual reduction of income tax statutory marginal tax rates, resulting in a permanent reduction of marginal tax rates (Figure 1).[2] The Israeli experience provides a unique opportunity to examine the impact of a permanent tax reduction on migration. Unlike the tax reduction analyzed in Kleven, Landais and Saez (2013) that targeted relatively narrow pools of potential migrants (soccer players) the Israeli tax reduction targeted the entire population. Moreover, the Israeli tax reduction was permanent, unlike the Danish tax cut studied in Kleven, Landais, Saez and Schultz (2014) that lasted only three years.

[2] Note that in the early 2000s the marginal tax rates for the 6th and 7th brackets were lower than the marginal tax rate applied to the 4th and 5th bracket. This apparent inconsistency was due to a threshold on National Insurance contributions at the relevant income ranges; above which the marginal contribution was zero.

Figure 1

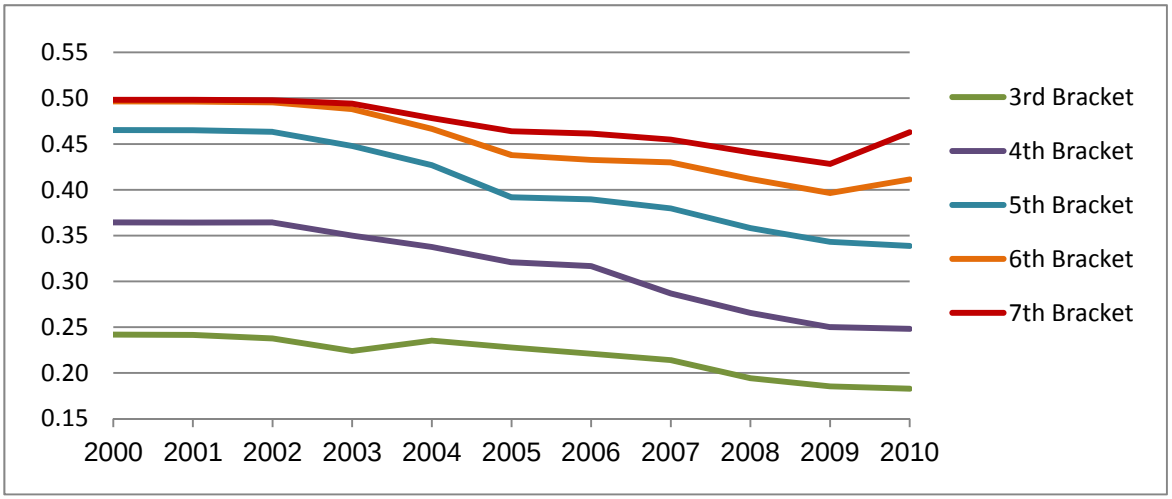
Changes in Marginal Tax Rates (income tax + national insurance contribution) 2000-2010



The reduction was not across the board. It affected the different income tax brackets at different intensities, resulting in a differential impact on the average tax rates, which are the relevant rates for migration decisions (Figure 2).

Figure 2

Changes in Average Tax Rates (income tax + national insurance contribution) 2000-2010



In this study, we attempt to exploit this variation in the effect on average tax rates across income levels in order to estimate the impact of these tax cuts on emigration flows of Israelis during the period 2000-2010.

2. A Brief Review of the Literature

There is substantial empirical evidence on the impact of tax rates and transfers on labor supply and income of individuals and households. Two broad surveys are Blundell and MaCurdy (1999) and Giertz, Saez and Slemrod (2012). There is also a strand of the literature that examines the impact of taxation on capital flows, as presented by Gordon and Hines (2002), Grifith and Devereux (2002) and Griffith, Hines, and Sørensen (2010). A third relevant strand of empirical literature deals with the wage gaps among immigrants as described by Borjas (1999). In a recent paper Borjas, Kauppinen and Poutvaara (2015) showed that for the Danish population the income distribution of emigrants stochastically dominates that of non-emigrants and that self-selection was driven primarily by unobservable characteristics.

The literature examining the impact of tax rates on international migration is relatively scarce. There are some works that examine the migration within a federation, such as, Wrobel and Feldstein (1998), Bakija and Slemrod (2004) and Varner and Young (2011) that document the impact of taxes on internal migration within the US; and Pommerehne and Kirchgassner (1996), and Liebig et al. (2007) that examined the migration between Swiss Cantons. However, to the best of our knowledge, the only studies that examined tax-induced international migration are Landais, Kleven and Saez (2013) and Landais, Kleven, Saez and Schultz (2014). The first paper studied the impact of tax incentives on migration of soccer players in 14 European countries in the period 1985-2008, finding an elasticity that is

close to one for foreign players on average and even higher for top soccer players. Landais, Kleven, Saez and Schultz (2014) used a differences-in-differences methodology to study the impact on migration of a tax reform that took place in Denmark in the beginning of the nineties, in which high-income wage-earners (exceeding 103 thousands Euro in 2009 prices) received a substantial tax reduction (of 34 percent over a three-years period). The study found a strong reaction to tax rates, with elasticity exceeding unity.

The policy implications of the above documented high migration elasticities were examined in two recent theoretical studies. Lehmann, Simula and Trannoy (2014) demonstrated that migration incentives could call for setting negative marginal tax rates at the top. Blumkin, Sadka and Shem-tov (2015) have demonstrated that in the presence of labor migration and tax competition, asymptotic optimal marginal tax rates should approach zero under plausible parametric assumptions regarding the underlying migration elasticities. Both studies indicate that migration may have a considerable impact on the optimal marginal tax rates, in sharp contrast to previous studies focusing on traditional margins of response (such as participation and labor supply).

Two works studied emigration from Israel. Gould and Moav (2007) characterized the emigration trends from Israel in the period 1995 to 2002, in terms of education, employment, income, family status and years of permanent residence in Israel. They found that educated individuals tend to emigrate more than non-educated ones. Whereas taxation was assumed to be one of the explanations for this result, their paper did not concentrate on the analysis of the impact of tax rates on emigration. In this paper, in contrast, we attempt to quantify the effect of wage and tax considerations on the emigration decision.

Cohen-Kastro (2013) has recently studied emigration decisions to specific destinations abroad. As in Gould and Moav (2007) she found that better educated individuals tend to emigrate more than their less educated counterparts. This constitutes the background for

our research that examines the emigration of educated individuals at different work branches.

3. Descriptive Statistics

Table 1 shows the characteristics of immigrants and emigrants by year and by gender. The data are based on flows of individuals that migrate for a period that is longer than one year.[3] We show statistics for both immigrants and emigrants, but will confine the econometric analysis to emigrants, for lack of relevant information regarding the immigrants, as they come from foreign countries.

Note that our data include all potential emigrants as we have the records of all the Israelis participating in the labor market who pay taxes.[4]

Table 1

Number of individuals according to direction of migration and gender

	In			Out			Total Sample		
Year	Males	Females	Total	Males	Females	Total	Males	Females	Total
2000	281	88	369	836	356	1,192	9,946	4,499	14,445
2001	227	82	309	1,381	714	2,095	10,589	5,094	15,683
2002	270	108	378	1,228	594	1,822	10,032	4,861	14,893
2003	229	100	329	979	481	1,460	8,899	4,365	13,264
2004	267	99	366	1,001	484	1,485	8,867	4,326	13,193
2005	286	127	413	866	429	1,295	9,043	4,187	13,230
2006	323	149	472	960	429	1,389	10,563	5,008	15,571
2007	324	129	453	1,102	517	1,619	11,862	5,612	17,474
2008	444	188	632	1,091	471	1,562	12,842	6,267	19,109
2009	357	149	506	817	390	1,207	12,682	6,431	19,113
2010	361	183	544	901	453	1,354	14,215	7,164	21,379
Total	3,369	1,402	4,771	11,162	5,318	16,480	119,540	57,814	177,354
Average	306	127	434	1,015	483	1,498	10,867	5,256	16,123

SOURCE: Based on Central Bureau of Statistics Migration data.

[3] See discussion of this point in Section 5 below.

[4] As the source of our data is the Israeli Tax Authority, the only wage earners excluded from our database are those that do not report their income. They constitute a very small group in Israel, because employers are required to withhold taxes when paying their employees, making it virtually impossible for wage earners to avoid reporting their taxable income.

Table 2

Emigrants and Israel 2010 by tax bracket (percent)

	Bracket				
Year	3	4	5	6	7
2000	55.6	30.2	12.6	1.1	0.4
2001	55.6	29.7	13.5	0.9	0.4
2002	57.0	29.0	12.6	1.1	0.3
2003	58.9	27.8	12.0	1.0	0.4
2004	58.7	27.8	12.1	1.0	0.3
2005	58.5	27.1	12.4	1.4	0.6
2006	57.0	27.3	13.5	1.7	0.5
2007	55.8	27.1	14.6	2.0	0.5
2008	54.3	26.3	16.2	2.6	0.7
2009	53.2	27.7	15.5	2.7	0.8
2010	52.7	27.7	16.0	2.8	0.7
Total	56.0	28.0	13.8	1.7	0.5
Israel 2010	46.7	27.0	22.8	2.9	0.7

SOURCE: Based on Central Bureau of Statistics Migration and Household income surveys data.

The total number of migrants we see in Table 1 (on the right-hand side of the table) refers to individuals that migrated at least once during the sample period. Thus, for a given year, we first see the number of individuals that actually migrated during that year, and on the right-hand side of the table, we see the number of people that worked during that year and migrated in any other year during our sample. All observations include migrants whose income falls in the third income tax bracket or higher (we show below the income characteristics of the sample). Note that examining the data in this particular manner allows us to consider the timing of migration. Given that the sample is composed of individuals with a high propensity to emigrate, the timing of emigration and whether it was affected by the tax reductions is our main interest.

Table 3 shows the migrants by age group. Most of them are in the middle range: 25-34 and 35-44 years old. In Table 4, we see the composition of migrants by religion. The Muslim population is under-represented in the list of migrants relative to its share of the general population. Individuals of “other religions” (individuals who are not Jews, Christians or Muslim) are over-represented in the list of migrant relative to their share in the general population.

Table 3

Emigrants by age group (percent)

Year	Age group					
	Up to 24	25-34	35-44	45-54	55-64	65 and above
2000	5.5	41.2	33.7	14.8	4.0	0.8
2001	4.6	40.9	31.6	16.0	5.9	1.1
2002	6.1	45.0	32.4	11.2	4.4	0.9
2003	3.8	44.0	33.6	12.3	5.5	0.8
2004	3.3	41.6	35.5	13.5	5.3	0.7
2005	3.2	41.2	36.1	12.4	6.3	0.9
2006	4.2	41.5	38.4	12.0	3.7	0.2
2007	4.3	40.0	39.1	11.5	4.7	0.4
2008	4.7	38.9	39.0	11.8	4.6	1.0
2009	4.6	41.1	37.0	11.4	5.2	0.7
2010	3.8	39.3	39.5	10.7	5.9	0.8
Total	4.4	41.4	35.8	12.6	5.1	0.8
Israel 2010	0.6	19.5	32.5	26.5	18.1	2.7

SOURCE: Based on Central Bureau of Statistics Migration and Household income surveys data.

Table 4

Emigrants by religion (percent)

Year	Jewish	Others	Muslim	Druze	Christian
2000	87.9	9.1	1.1	0.1	1.8
2001	86.5	10.4	1.2	0.1	1.8
2002	84.6	12.1	1.2	0.1	2.0
2003	83.5	13.2	1.4	0.1	1.8
2004	82.9	13.7	1.6	0.1	1.7
2005	82.9	13.7	1.5	0.2	1.7
2006	82.6	13.7	1.8	0.2	1.7
2007	83.7	12.7	1.9	0.2	1.5
2008	85.2	11.2	2.1	0.2	1.3
2009	87.6	8.6	2.3	0.2	1.4
2010	88.2	7.9	2.5	0.2	1.3
Total	85.2	11.3	1.7	0.2	1.6
Israel 2010	94.6			5.4	

SOURCE: Based on Central Bureau of Statistics Migration and Household income surveys data.

In Table 5, we look at the annual mean and quartile wages of the migrants. We see that their wages are lower than the average in Israel in 2010. In order to learn about the relative position of migrants we compare in Table 6 their monthly wages to monthly wages of all wage earners classified by gender (i.e., we compared men migrants to all men wage earners, and did the same for women). It turned out that the distribution is similar to that in the general population in 2010.

Table 5

Emigrants' and Israel 2010 annual wage, mean and quartiles (nominal NIS)

Year	Mean	p25	p50	p75
2000	133,948	87,144	111,243	161,433
2001	130,313	85,896	109,327	160,947
2002	126,825	85,744	107,799	155,344
2003	123,398	84,931	105,393	151,427
2004	125,435	84,782	105,606	152,105
2005	125,826	84,335	104,357	153,796
2006	128,525	84,463	105,690	158,566
2007	129,225	81,821	105,251	159,870
2008	136,370	83,143	108,292	168,714
2009	135,812	83,829	108,224	168,730
2010	139,414	84,648	110,452	170,756
Total	130,834	84,822	107,553	160,087
Israel 2010	202,765	123,156	159,156	227,634

SOURCE: Based on Central Bureau of Statistics Migration and Household income surveys data.

Table 6

Relative monthly wage of emigrants and Israel 2010 (from 3rd bracket upwards) compared to average wage of his/her gender peers

Percentiles	1%	5%	10%	25%	50%	75%	90%	95%	99%	Mean
Emigrants	0.7	0.8	0.9	1.0	1.4	2.0	2.9	3.6	5.8	1.8
Israel 2010	0.9	0.9	1.0	1.2	1.6	2.2	3.1	4.0	6.9	2.0

SOURCE: Based on Central Bureau of Statistics Migration and Household income surveys data.

In Table 7, we look at the level of education of migrants and the composition of their occupations. We see that migrants have lower education levels compared to the general population, with the exception of high-tech industries at the range of 13-15 years of education.

Table 7

Migrants and Israel 2010 by Years of Schooling (percent)

	Migrants				
Years of schooling	In	Out	Hi tec	Low tec	Israel 2010
0-10	4.6	8.0	3.0	14.5	3.4
11-12	27.4	31.5	26.0	42.4	20.8
13-15	24.0	27.8	33.6	23.8	26.0
16+	44.0	32.6	37.4	19.3	49.9

SOURCE: Based on Central Bureau of Statistics Migration and Household income surveys data.

Table 8 shows that relative to the general population emigrants are more likely to be married.

Table 8

Migrants and Israel 2010 population by marital status (percent)

	In	Out	Israel 2010
Married	84.4	82.7	81.5
Non-Married	15.6	17.3	18.5

SOURCE: Based on Central Bureau of Statistics Migration and Household income surveys data.

In order to learn more about migrants' characteristics, we looked at their wages by their technological occupation,[4] as shown in Table 9. The average wage ratio of migrants is high for hi-tech industries. It is also higher than 1 for low-tech industries. The hourly alternative wage in the US (which is a strong migration reference for Israelis) for high-tech jobs is high, reaching more than three times the average wage in Israel. This makes the emigration decision a relevant option.[5]

Table 9

Wage and alternative wage by technological intensity

	In		Out			Israel 2010
	Hi tec	Low tec	Hi tec	Low tec	Total	
monthly wage (NIS)	19,516	10,678	17,061	10,278	14,030	16,676
wage ratio (relative to gender peers average wage)	2.4	1.3	2.2	1.3	1.8	2.0
average income tax rate	20.5%	9.9%	20.0%	11.0%	15.0%	
net hourly alternative wage in US$	34.8	31.6	35.1	31.0	17.7	

SOURCE: Based on Central Bureau of Statistics Migration and Household income surveys data.

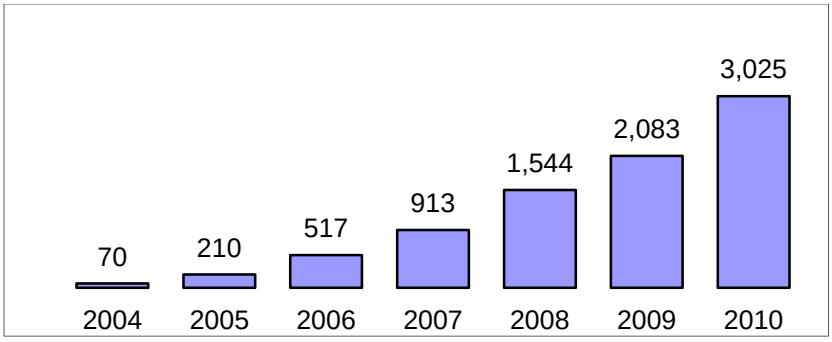
In our econometric analysis we are interested in controlling for all factors that affect migration that are not related to the income tax reductions of 2000-2010. Such a variable is a program known as "Returning Home" which was launched by the Ministry of Migration during the 2000s, mainly after 2008. That program offered eligible participants an exemption from Israeli tax of their foreign sourced income, for a period of ten years. The following figure shows the number of migrants affected by that program, which reached more than 3,000 at the end of our sample. As we run regressions only for emigrants, it is worth stressing that ex-ante we expect these individuals to emigrate less, since their tax shelter is dependent upon staying in Israel. We have controlled for those migrants in our regressions.

[4] The classification was used by the Central Bureau of Statistics and became the standard in Israel. High tech includes medicines, computers, electronic and optic devices, planes and spaceships; low tech includes food, drinks, tobacco, textile, shoes, leather, paper, printing, wood and furniture.

[5] In Section 5 below we elaborate on the methodology used to calculate the net hourly alternative wage rates.

Figure 3

Number of workers who migrated in "Returning Home" Program



SOURCE: Based on Ministry of Aliyah and Immigrant Absorption and Central Bureau of Statistics Migration data.

In Table 10, we show the composition of emigrants by the number of months they worked during the year. This table clearly shows that most emigrants were full-time workers.

Table 10

Emigrants by work Months (frequency and percent)

year	0 (Business only)	1	2	3	4	5	6	7	8	9	10	11	12	Total
2000	351	165	207	202	217	240	313	349	392	363	453	474	8,562	12,288
	2.9	1.3	1.7	1.6	1.8	2.0	2.6	2.8	3.2	3.0	3.7	3.9	69.7	100.0
2001	352	198	201	270	297	309	371	429	532	469	527	517	8,765	13,237
	2.7	1.5	1.5	2.0	2.2	2.3	2.8	3.2	4.0	3.5	4.0	3.9	66.2	100.0
2002	346	228	212	260	281	275	358	395	477	421	450	458	8,181	12,342
	2.8	1.9	1.7	2.1	2.3	2.2	2.9	3.2	3.9	3.4	3.7	3.7	66.3	100.0
2003	330	223	221	211	248	254	297	316	410	340	375	383	7,099	10,707
	3.1	2.1	2.1	2.0	2.3	2.4	2.8	3.0	3.8	3.2	3.5	3.6	66.3	100.0
2004	311	199	184	222	263	245	275	287	407	331	384	338	6,885	10,331
	3.0	1.9	1.8	2.2	2.6	2.4	2.7	2.8	3.9	3.2	3.7	3.3	66.6	100.0
2005	372	213	202	198	243	247	300	265	375	298	353	367	6,537	9,970
	3.7	2.1	2.0	2.0	2.4	2.5	3.0	2.7	3.8	3.0	3.5	3.7	65.6	100.0
2006	431	238	185	202	279	293	317	339	424	334	384	422	7,409	11,257
	3.8	2.1	1.6	1.8	2.5	2.6	2.8	3.0	3.8	3.0	3.4	3.8	65.8	100.0
2007	506	311	246	275	324	339	330	349	441	379	373	441	7,884	12,198
	4.2	2.6	2.0	2.3	2.7	2.8	2.7	2.9	3.6	3.1	3.1	3.6	64.6	100.0
2008	558	304	248	259	368	331	345	384	452	438	419	557	8,259	12,922
	4.3	2.4	1.9	2.0	2.9	2.6	2.7	3.0	3.5	3.4	3.2	4.3	63.9	100.0
2009	634	242	255	253	330	305	318	351	403	345	382	406	8,191	12,415
	5.1	2.0	2.1	2.0	2.7	2.5	2.6	2.8	3.3	2.8	3.1	3.3	66.0	100.0
2010	727	207	206	272	321	319	360	369	436	378	435	470	8,986	13,486
	5.4	1.5	1.5	2.0	2.4	2.4	2.7	2.7	3.2	2.8	3.2	3.5	66.6	100.0
Total	4,918	2,528	2,367	2,624	3,171	3,157	3,584	3,833	4,749	4,096	4,535	4,833	86,758	131,153
	3.8	1.9	1.8	2.0	2.4	2.4	2.7	2.9	3.6	3.1	3.5	3.7	66.2	100.0

SOURCE: Based on Central Bureau of Statistics Migration data.

Our analysis concentrates on emigrants by technological occupation. We also pay attention to employment by multinational companies, because working for a multinational may affect

the ease and tendency of emigration. The statistics for this population are shown in Table 11.

Table 11

Number of Emigrants by technological intensity and multinational company

Year	Hi tech	Low tech	Multinational
2000	84	36	117
2001	128	62	214
2002	115	58	157
2003	88	61	117
2004	107	71	144
2005	82	47	122
2006	121	74	135
2007	147	84	207
2008	76	71	136
2009	51	54	109
2010	73	51	109
Total	1,072	669	1,567
Average	97	61	142

SOURCE: Based on Central Bureau of Statistics Migration and Household income surveys data.

4. Expected response to tax reductions

4.1 An Illustrative Model

We propose a simple reduced-form illustrative model that characterizes individuals' response to a persistent tax reduction announced by the government. The key purpose of the model is to provide a parsimonious conceptual framework that highlights the dynamic migration incentives associated with tax reductions. The essence of the model is that individuals 'vote with their feet' retrospectively in response to government's persistence (or lack of persistence) in maintaining a pre-announced policy reform that specifies a trajectory of tax cuts [the model is in the spirit of the classic retrospective voting model of Ferejohn (1986)]. It is assumed that the tax reduction is announced at the outset, but we allow for time inconsistency by further assuming that with some positive probability the government may renege on its announced policy on an annual basis, during the preparation of the annual

budget.[6] We let 0<*p*<1 denote the (perceived) probability of implementing the tax reduction. Alternatively, (1-*p*) measures the (perceived) extent of time inconsistency of the government in implementing its pre-announced policy reform. We simplify by assuming that this probability is fixed across time. In case the resident of the origin country, in which the tax reform has been legislated, chooses to stay and the tax reduction actually takes place, he benefits both from the tax reduction and the migration costs avoided. At the outset of the first tax reduction, the discounted expected gain from not migrating, for an individual whose income level lies within an income tax bracket *k*, *k=3,4,....7*, is given by:

$$(1)\ G_1^k = pt_1^k + pC_1^k + p\sum_{i=2}^{n}\left[\frac{t_i^k}{(1+r)^{i-1}}\right] + p\sum_{i=2}^{n}\left[\frac{C_i^k}{(1+r)^{i-1}}\right]$$

Where *G* is the discounted expected gain from not migrating, *t* denotes the amount of tax reduction, *C* denotes the migration cost, r denotes the real interest rate, *n* denotes the duration of the announced tax reform, the superscript refers to the tax bracket and the subscript refers to time.

At the outset of the second period, provided that the tax was actually reduced, the discounted expected gain is:

$$(2)\ G_2^k = t_1^k + C_1^k + p\sum_{i=2}^{n}\left[\frac{t_i^k}{(1+r)^{i-1}}\right] + p\sum_{i=2}^{n}\left[\frac{C_i^k}{(1+r)^{i-1}}\right]$$

Thus, if the government implements its proposed policy reform and extends a tax reduction, the individual has a retrospective gain from avoiding emigration, which equals:

$$(3)\ G_2^k - G_1^k = (t_1^k + C_1^k)(1-p)$$

Several remarks are in order. First notice that the larger the probability of reneging is (that is, the likelihood of not implementing the announced reform) the higher is the retrospective

[6] Concerning the income tax reduction discussed in the present study, out of 13 years of legislated tax reductions (from 2004 until 2016) only 8 have been actually implemented. Examples of proposed tax changes that are eventually discarded are common both in Israel and other countries. The last well-known policy reversal is related to the 'social protest' in the summer of 2011, which resulted in the abolition of the pre-announced income and corporate tax reductions from 2011 until 2016.

expected gain associated with eschewing from migration. This retrospective gain is increasing over time, when the government persists and implements its preannounced reform as time elapses.

Further notice that when the government does not persist and is ex-post reneging on its pre-announced reform (for simplicity we assume that the government is confined to making a discrete choice whether to fully implement the reform or utterly abolishing it), the retrospective gain is decreasing over time and may become negative (a retrospective loss). Thus, if the tax remains unchanged during the first period, then at the outset of the second period the discounted expected gain is given by:

(2') $$G_2^k = p\sum_{i=2}^{n}\left[\frac{t_i^k}{(1+r)^{i-1}}\right] + p\sum_{i=2}^{n}\left[\frac{C_i^k}{(1+r)^{i-1}}\right].$$

Hence, the retrospective gain is negative (a loss) and given by:

(3') $$G_2^k - G_1^k = -p(t_1^k + C_1^k).$$

It follows by virtue of (3') that the retrospective loss increases with respect to the probability of implementing the pre-announced tax reform.

Finally notice that our model is non-Bayesian, so that individuals are not updating the prior probability of reneging in response to the government choice whether or not to keep its promises.[7] However, the increase (decrease) in the retrospective gain, in light of the government's persistence (lack of persistence), is essentially capturing the notion of a Bayesian updating rule, mirroring a process in which the posterior probability of reneging would decrease (increase) over time; that is, individuals become gradually convinced over time that the government's propensity to renege is low (high). This in turn will enhance (diminish) the attractiveness of staying in the origin country (the non migration option).

[7] In a Bayesian framework, governments would differ in the propensity to renege, an attribute unobserved by the individuals. Individuals will form some prior beliefs about the chances of facing different types of governments. The prior probability distribution over the set of types will be updated in a Bayesian fashion conditional on the choice of the government whether or not to renege on its pre-announced policy reform.

To demonstrate the evolution of the retrospective gain over time (provided that the government persists in implementing its pre-announced reform), suppose that the government reduces taxes also in the third year.[8] The total gain, in present value terms, derived by an individuals who avoids from migrating is given by:

(4) $$G_3^k - G_1^k = \left(t_1^k + C_1^k\right)(1-p)(1+r) + \left(t_2^k + C_2^k\right)(1-p)$$

By induction it is easy to generalize the expression in (4) and obtain:

(5) $$G_j^k - G_1^k = (1-p)\left[\sum_{i=1}^{j-1}\left(t_i^k + C_i^k\right)(1+r)^{j-i-1}\right]$$

Thus, over time, provided that the government persists in implementing its preannounced policy reform of tax reductions, as *i* increases the retrospective gain is increasing, thereby rendering the option of not migrating more attractive.

We assume that individuals' preferences are represented by a strictly concave utility that is strictly increasing with respect to the total discounted expected retrospective gain from non-migration.

(6) $U = U(G_j^k - G_1^k)$, with *U'>0* and *U''*<0

Each year (*j*=1,2,…n) each individual compares the retrospective gain, given by the expression in (6) with some idiosyncratic threshold, *v*. It is assumed that for each income tax bracket, denoted by *k=3,4,..7*, the threshold is drawn from some continuous probability distribution, $F_k(v)$, with strictly positive densities, *F'*>0. The migration choice is then characterized by a cut-off rule: migrate at time *j*, if-and-only-if, $U\left(G_j^k - G_1^k\right) < v$.

The probability of non-migration at time *j* for an individual whose income falls within a tax bracket, *k*, is hence given by:

[8] In the context of the Israeli tax reform, tax reductions indeed persisted for 8 years, namely, the government has implemented the pre-announced tax reduction consecutively over the course of 8 years.

(7) $\Pr[v \leq U(G_j^k - G_1^k)] = F_k[U(G_j^k - G_1^k)]$.

It immediately follows from (7), as both *F* and *U* are strictly increasing, that the probability of non-migration is increasing in the level of the retrospective gains.

Aggregating over the entire population, the population-wide probability of non-migration at time *j* is given by:

(7') $P_j = \frac{\sum_{k=3}^{7} \gamma^k F_k[U(G_j^k - G_1^k)]}{\sum_{k=3}^{7} \gamma^k}$,

where γ^k denotes the number of individuals whose income falls within tax bracket *k*.

In figure 4 we provide an illustrative simulation of the expected response to the tax reductions that occurred in Israel (figures 1 and 2). The calibration was performed according to the results shown in Table 15 below, for the whole population. In particular, we calibrated the utility threshold so as to reproduce a trend toward 55 percent emigration reduction at the end of the sample for the 4th bracket.[9] In addition, we make the following parametric assumptions: (i) the costs of migration are increasing for the first three years, decreasing afterwards, and they are given (as a percentage of the wage) by: 2, 5, 10, 15, 12, 10, 10 respectively for 2004-2010; (ii) there is no discounting (r=0); (iii) the probability of implementing the tax reduction is constant across time and given by *p*=0.5; (iv) *F* is given by a uniform distribution over the support [5.5, 25], measured as a percentage of the wage and is identical across tax brackets; [10] and (*v*) the utility *U* is taking a logarithmic functional form. We also conduct a robustness check by considering the commonly used Pareto distribution with a Pareto coefficient given by $\alpha = 1.5$ and the lower bound of the support given by 8 instead of assuming that *v* distributes uniformly (figure 4b).

[9] This number is obtained by dividing in Table 15 the emigration reduction by the total number of leaving workers per year.

[10] The actual tax reduction range was between 1.4 and 29.1 percent of wage.

Figure 4a

Simulation of expected reduction in emigration (in % of total population) in response to Tax Reductions with a Uniform Threshold-Distribution

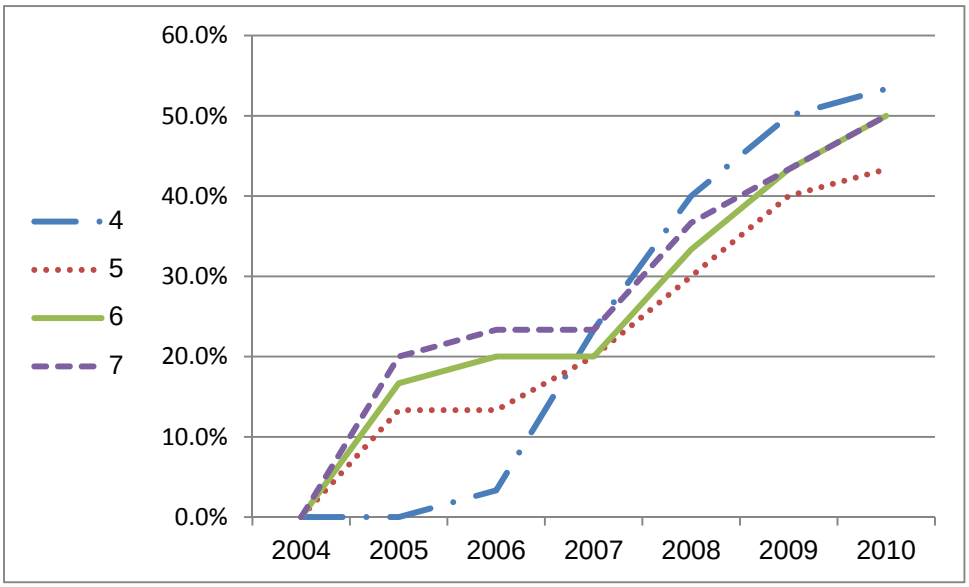
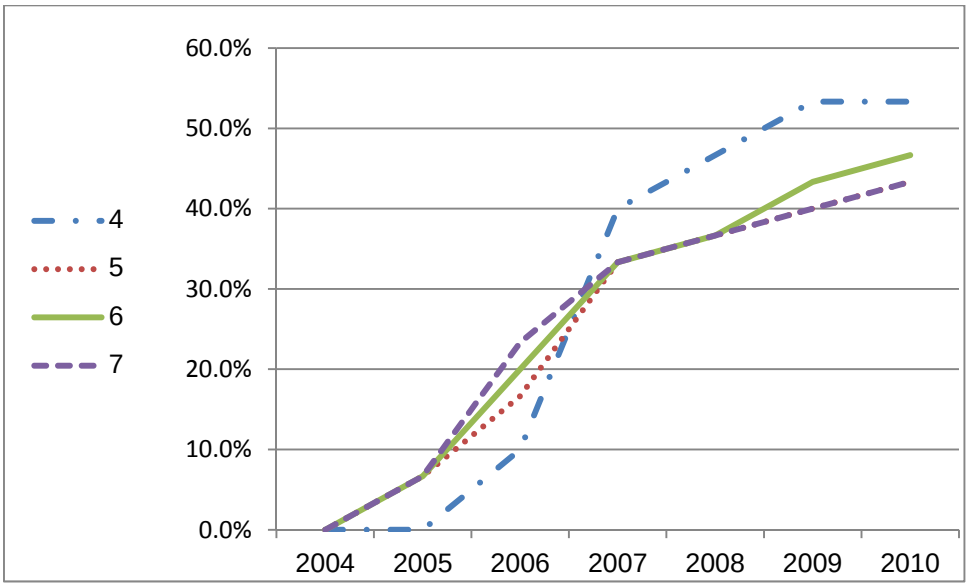


Figure 4b

Simulation of expected reduction in emigration (in % of total population) in response to Tax Reductions with a Pareto Threshold-Distribution



Figures 4a and 4b illustrate the expected behavior (for the two specifications of the threshold distribution) in response to the persistent tax reductions implemented in Israel over the years 2004-2010. Notice that the vertical axis of each figure represents the

population-wide probability of non-migration, namely the fraction of the population that chooses not to migrate. In line with the increase in the retrospective gain the simulations indicate an increase in emigration reduction for all tax brackets. Notice further, that in both specifications we expect to observe at the beginning of the sample a faster decrease in emigration for the 5^{th}, 6^{th} and 7^{th} bracket, since tax reductions for these brackets were higher. Whereas in the uniform distribution specification we expect the emigration reduction pattern to start from the beginning of the sample (except for the 4^{th} bracket that experienced a lower tax reduction) and be gradual, in the Pareto distribution case we expect a faster reduction of emigration flows in 2006 and 2007, when the accumulated tax reductions became substantial.

4.2 Difference-in-Difference Analysis

In this section, before turning to the full econometric model (presented in the coming section) and in order to gain some preliminary insights, we estimate the expected response to the tax reductions by performing a diff-in-diff exercise. Note that as shown in Figure 2, the tax reduction associated with the 3rd bracket is significantly lower than those associated with the higher brackets. Our analysis will focus on comparing the emigration flows before and after the tax reductions (i.e., before and after 2004) for the treated group (4^{th} to 7^{th} brackets) compared with the control group (3^{rd} bracket), in order to separate the change in emigration flows associated with the tax reductions from those attributed to the time trend. The latter is captured by the evolution of emigration flows within the 3^{rd} bracket, based on the identifying assumption that time trends in emigration patterns are shared by individuals across income tax brackets. In order to perform the analysis we pursued a Propensity Score Matching methodology. In Appendix B we show that PSM substantially improves the matching of characteristics among treatment and control groups. We have excluded from

the analysis the 7th bracket, due to a small number of observations. The result of the analysis, using the PSM series, is shown in Figure 5.

Figure 5

The reduction in emigration by Income tax brackets (compared to the 3rd bracket, in % of average number of emigrants by bracket during 2000-2003)

Figure 5 shows the difference between the reduction in emigration flows associated with the 4th, 5th and 6th bracket and the 3rd bracket, which was, roughly speaking, not subject to a tax reduction. The difference in the number of emigrants is reported as a share of the annual flow of emigrants for each bracket. For example, in 2004 we see that the emigration reduction for the 4th bracket was 25 percent higher than the one that occurred in the same year for the 3rd bracket. Several observations emerge from closely examining figure 6. First, the earliest jump in the reduction in emigration flows occurs within the 5th bracket. Second, as expected from the simulation, the reduction in the flow of emigrants increases over time within all brackets. Finally, the strongest effect is documented within the 5th and 6th brackets which were subject to a more intense tax reduction.

Table 12 shows the statistical significance of the decrease in emigration in response to a persistent tax reduction during a sub-period (2004 until 2007) and the whole period (2004

until 2010). Consistently with the findings shown above, the reported significance is based on the series following the PSM re-writing. To learn about the statistical significance we use t values[11].

Table 12

The statistical significance of the diff-in-diff response to tax reductions (t values)

(* significant at 10 percent; ** significant at 5 percent; *** significant at 1 percent)

Period/ Bracket	4		5		6	
	Using 4th bracket sd	Using 3rd bracket sd	Using 5th bracket sd	Using 3rd bracket sd	Using 6th bracket sd	Using 3rd bracket sd
2004-2007	-2.2 (**)	-2.1 (**)	-0.93	-1.90 (*)	-0.55	-0.82
2004-2010	-1.75 (*)	-1.9 (*)	-1.66 (*)	-3.37 (***)	-1.15	-1.72 (*)

When we use the own bracket standard deviation for calculating the t-statistic, results are significant for the 4th and 5th bracket. Using the 3rd bracket standard deviation, instead, for calculating the t-statistic, we find that the diff-in-diff t-statistic is significant at least at 10 percent for all brackets during the 2004-2010 period. These results emphasize that the emigration reduction for employees belonging to the brackets that were subject to a permanent tax reduction was statistically significant.

5. Econometric Analysis

In this section we perform an econometric analysis of the emigration decision, using a framework that embeds the key insight from the illustrative model presented above, namely that the emigration decision is associated with the cumulative gains from tax reductions.

As explained in Section 3, the data is based on migration flows that are longer than one year. This opens the possibility that an emigrant left Israel for a short period of time, say, 2 years, and returned to Israel. Two comments are in order: i) our econometric analysis is not aimed at explaining permanent migration, but rather attempts to shed light on the relationship between the timing of migration (for shorter or longer periods of time) and the generosity of

[11] An Individual is assigned to brackets according to his permanent position; when it is volatile, his average bracket is used.

the tax reductions; ii) concerning emigrants, we have the possibility of tracking their employment history, assuming that once they come back they return to the labor market – which is the representative case (note that according to the data shown above, the bulk of emigrants take their decision at an early stage – between 25 and 44 years old). There are 9,428 observations of this type, which represent 5.3 percent of our migrations sample. For 2,000 out of them we have data on the duration of their stay abroad, which averages 521 days, with a minimum of 364 days and a maximum of 3,097 days.

In order to allow the data to provide disaggregate information, we will separate our analysis by looking into two groups of individuals: high-tech and low-tech workers. High-tech industries are based on the global development of technologies around the world, and consequently the human capital (know-how associated with education and/or on-the-job experience) of workers in these industries is typically transferrable to a large extent across countries and job prospects of these workers are, hence, less sensitive to fluctuations in local demand. In contrast, low-tech workers are more dependent on local demand[12], thus we expect that the net benefits from migration would be higher for high-tech workers. The difference in the education patterns between these two sectors is readily reflected in Table 7: the share of workers in the high-tech with years of schooling weakly exceeding 16 is 37 percent, compared with 19 percent in the low tech.

We generalize this framework by including all other relevant factors that affect emigration, which include: gender, age, religion, participation in the "Returning Home" Program, marital status, affiliation with multinational companies, and economic factors. The latter include the main macroeconomic and microeconomic variables. Among the first category, we included the unemployment rate in Israel and in the main destination countries (G7). Concerning microeconomic factors, we calculated the alternative wage based on Mincer regressions, namely the hypothetical wage rate that could be earned in the destination country conditional on the observed characteristics of the worker. The calculation is based on the findings shown by Polachek [(1981) and more recently (2008)) who constructed Mincer equations that include occupational affiliation, age and gender as explanatory variables of the observed wage in a large group of developed economies. Using the reported coefficients we imputed an alternative wage for each emigrant, which is based on his/her own personal characteristics (gender, age and occupation). For this purpose we used data from the US,

[12] Jaimovich and Siu (2012) show, for instance, that the demand for jobs that are homogeneous and that do not require creativity (routine and middle-skilled jobs) collapses during recessions, resulting in persistent unemployment within these occupations.

France and the UK. Based on administrative data regarding the statutory tax rates in place, we have calculated the average tax rate for each individual and derived his/her alternative net wage.

The key regression specification takes the following form:

$$E_{i,t} = C_i + ANW_{i,t} + W_{i,t} + IT_{i,t} + Z_t,$$

where the dependent variable E represents the emigration decision for a worker of sector i at time t. Note that individuals may decide to emigrate in every single year during the sample, whereas in practice they do so at a particular timing. C represents the emigration cost/benefit that is idiosyncratic to each sector, where i=1 (high tech) and i=2 (low tech); ANW is the alternative net wage at the destination country which is calculated as a weighted average of the alternative wage rates in the US (50 percent), France (25 percent) and the UK (25 percent)[13]; W is the gross wage in Israel; IT is the income tax; and Z is the vector of the control variables, including gender, age, squared age, religion (muslim, christian, druze), unemployment in Israel, unemployment in G7 countries, marital status and some interaction terms as we explain later . Note also that we include the business wage (namely, the cost incurred by the employer) as an additional variable, although for data quality considerations we base our analysis on employees' wages.

In Table 13 we show the results of the basic specification using d(probit). Columns 1 and 2 present the fixed effect for high-tech and low-tech employees respectively, in a separate way (i.e., compared to all other sectors); Column 3 presents the results when fixed effects appear together at the same regression (compared to all other sectors besides those two). The coefficients represent the marginal effect of a change in the independent variables, in probability terms. Note that all (micro and macro) variables have the expected sign. The alternative net wage is positive which means that raising it implies an increase in emigration from Israel. The wage in Israel has a negative sign, whereas the income tax has a positive sign. The coefficient of taxation means that if we reduce taxes by 1,000 NIS, the probability of emigration is reduced by 0.00032. The "Returning Home" Program, as expected, has a negative and significant sign. A rise in unemployment in G7 countries reduces emigration from Israel, whereas a rise in unemployment in Israel works in the opposite direction, as expected.

[13] The US and Europe account for 90 percent of Israelis' emigrations.

Note further that females are less likely to emigrate, whereas young people are more likely to do so (and vice versa for old people). Note also that the non-Jewish population (Muslim, Druze and Christian) is less likely to emigrate (although for Christians the coefficient is not significantly different from zero).

The most interesting result from the point of view of our model is related to migration costs and tax reductions. Migration costs are captured by the constant term of each sector: high-tech and low-tech. Note that for High-tech the constant is positive, which implies that in this sector there is a positive (ex-ante) propensity to emigrate, reflecting a net benefit derived from emigrating. High-tech workers can relocate incurring relatively low mobility costs and in many cases, migration can in fact enhance job prospects for the skilled migrants. For low-tech workers, in contrast, migration costs are sizable. Accordingly, the constant term is negative for the Low-tech workers.

As expected, tax reductions decrease the likelihood of emigration, although, notably, the coefficient is lower (in absolute terms) than that associated with the wage. Thus, in order to avoid a 'brain drain' the government has to more than compensate the potential emigrants for the gross wage differentials between the origin and destination countries, through the implemented tax cuts. Note that as we include the gross wage rate and the income tax as two separate explanatory variables in the regression, consistency considerations imply that the coefficients of W and IT should be equal in absolute value (and with opposite sign). The apparent inconsistency may reflect a 'risk-premium' that measures the uncertainty revolving around whether the government will actually implement the pre-announced tax reductions.

Hi-tech and Low-tech workers are obviously heterogeneous. Hence, in order to quantify the true impact of the tax reductions on these markedly different types of workers it is necessary to examine separately the effect of tax reductions on each group of workers. This is done in Table 14.

Table 13

Emigration Response to Tax Reductions and Migration Costs

Equation Number	1		2		3	
Dependent variable	Out		Out		Out	
	dF/dx	Pv	dF/dx	Pv	dF/dx	Pv
US, UK and France net alternative wage[a]	0.00004	(0)***	0.00005	(0)***	0.00005	(0)***
Employee wage[a]	-0.00074	(0)***	-0.00074	(0)***	-0.00074	(0)***
Business wage[a]	-0.00081	(0.001)***	-0.00082	(0)***	-0.00082	(0)***
Income tax[a]	0.00032	(0)***	0.00032	(0)***	0.00032	(0)***
Female	-0.00492	(0)***	-0.00442	(0.003)***	-0.00450	(0.002)***
Age	0.00473	(0)***	0.00467	(0)***	0.00466	(0)***
Age^2	-0.00005	(0)***	-0.00005	(0)***	-0.00005	(0)***
Muslim	-0.02526	(0)***	-0.02555	(0)***	-0.02550	(0)***
Druze	-0.05259	(0)***	-0.05277	(0)***	-0.05272	(0)***
Christian	-0.00339	(0.449)	-0.00358	(0.424)	-0.00355	(0.427)
"Returning Home" Program	-0.07048	(0)***	-0.07047	(0)***	-0.07046	(0)***
Unemployment in Israel	0.00394	(0)***	0.00358	(0)***	0.00388	(0)***
Unemployment in G7	-0.00394	(0)***	-0.00449	(0)***	-0.00386	(0)***
Single	0.00923	(0)***	0.00981	(0)***	0.00970	(0)***
Single Female	-0.01089	(0.001)***	-0.01121	(0.001)***	-0.01115	(0.001)***
Multinational	0.00507	(0.027)**	0.00557	(0.015)**	0.00518	(0.024)**
Unemployment in Israel * High tech	-0.00890	(0)***	-0.00408	(0.01)***	-0.00895	(0)***
Unemployment in G7 * High tech	-0.00369	(0)***	0.00821	(0)***	-0.00356	(0.31)
Year 2000	-0.01226	(0)***	-0.01256	(0)***	-0.01206	(0)***
Year 2001	0.02874	(0)***	0.02875	(0)***	0.02906	(0)***
Year 2002	0.01168	(0)***	0.01172	(0)***	0.01175	(0)***
Year 2009	-0.00908	(0)***	-0.00906	(0)***	-0.00915	(0)***
Year 2000 * High tech	-0.01884	(0.018)**	-0.00944	(0.246)	-0.01850	(0.021)**
Year 2001 * High tech	-0.02427	(0)***	-0.01986	(0.004)***	-0.02396	(0)***
High Tech	0.17164	(0)***			0.16604	(0)***
Low Tech			-0.01576	(0)	-0.01555	(0)***
Pseudo R^2	0.088		0.088		0.088	
Number of observations	177,354		177,354		177,354	

Probit regression, reporting marginal effects. *** Significant at 1 %; ** Significant at 5 %.
SOURCE: Based on Central Bureau of Statistics Migration data.
[a]1,000 NIS, current prices.

Table 14

Emigration Response to Tax Reductions and Migration Costs allowing for interactions

Equation Number	1		2		3	
Dependent variable	Out		Out		Out	
	dF/dx	Pv	dF/dx	Pv	dF/dx	pv
US, Uk and France net alternative wage[a]	0.00006	(0)***	0.00005	(0)***	0.00006	(0)***
Employee wage[a]	-0.00087	(0)***	-0.00072	(0)***	-0.00084	(0)***
Business wage[a]	-0.00093	(0)***	-0.00080	(0)***	-0.00091	(0)***
Income tax[a]	0.00074	(0)***	0.00030	(0)***	0.00071	(0)***
Female	-0.00256	(0.086)*	-0.00431	(0.003)***	-0.00257	(0.84)
Age	0.00451	(0)***	0.00447	(0)***	0.00447	(0)***
Age^2	-0.00004	(0)***	-0.00004	(0)***	-0.00004	(0)***
Muslim	-0.02496	(0)***	-0.02567	(0)***	-0.02513	(0)***
Druze	-0.05215	(0)***	-0.05250	(0)***	-0.05205	(0)***
Christian	-0.00298	(0.509)	-0.00338	(0.449)	-0.00286	(0.526)
"Returning Home" Program	-0.07020	(0)***	-0.07032	(0)***	-0.07009	(0)***
Unemployment in Israel	0.00306	(0)***	0.00379	(0)***	0.00303	(0)***
Unemployment in G7	-0.00308	(0.001)***	-0.00366	(0)***	-0.00295	(0.002)***
Single	0.00967	(0)***	0.00976	(0)***	0.00942	(0)***
Single Female	-0.01221	(0)***	-0.01122	(0.001)***	-0.01185	(0)***
Multinational	0.00476	(0.038)**	0.00543	(0.018)**	0.00467	(0)***
High tech	0.14928	(0)***	0.18827	(0)***	0.15485	(0)***
Low tech	-0.01494	(0)***	0.12199	(0)***	0.10957	(0)***
Unemployment in Israel * High tech	-0.00666	(0.001)***	-0.00845	(0)***	-0.00663	(0.001)***
Unemployment in G7 * High tech	-0.00622	(0.075)*	-0.00403	(0.219)	-0.00634	(0.069)*
High tech * Single Male	-0.00517	(0.527)	-0.00621	(0.444)	-0.00497	(0.543)
High tech up to age 35	-0.01632	(0)***	-0.01525	(0.001)***	-0.01643	(0)***
Year 2000	-0.01424	(0)***	-0.01213	(0)***	-0.01418	(0)***
Year 2001	0.02680	(0)***	0.02901	(0)***	0.02689	(0)***
Year 2002	0.01037	(0)***	0.01154	(0)***	0.01022	(0)***
Year 2009	-0.00876	(0.001)***	-0.00905	(0)***	-0.00869	(0.001)***
Year 2000 * High tech	-0.01350	(0.102)	-0.01726	(0.032)**	-0.01352	(0.101)
Year 2001 * High tech	-0.02143	(0.002)***	-0.02320	(0.001)***	-0.02148	(0.002)***
High tech * Employee wage[a]	0.00026	(0)***			0.00023	(0)***
High tech * Business wage[a]	-0.00072	(0.353)			-0.00074	(0.339)
High tech * Income tax[a]	-0.00070	(0)***			-0.00067	(0)***
Low tech * Employee wage[a]			-0.00138	(0)	-0.00128	(0)***
Low tech * Business wage[a]			-0.00115	(0)	-0.00097	(0)***
Low tech * Income tax[a]			0.00222	(0)	0.00201	(0)***
Pseudo R^2	0.092		0.090		0.094	
Number of observations	177,354		177,354		177,354	

Probit regression, reporting marginal effects. *** Significant at 1 %; ** Significant at 5 % * Significant at 10 %
SOURCE: Based on Central Bureau of Statistics Migration data.
[a]1,000 NIS, current prices.

The results shown in Table 14 indicate that the signs of all coefficients are as expected, with a statistical significance that in most cases is less than 1 percent. Among the controls we

included interactions of unemployment in Israel and in G7 countries, which show that hi-tech is less sensitive to local unemployment and more sensitive to unemployment abroad. We also controlled for years that represented a remarkable phase of a cycle: 2000 (high rate of growth) and 2001, 2002 and 2009 (recessions). For 2000 and 2001 we allowed for an interaction with high-tech, since 2000 represents the high-tech bubble and 2001 its burst. Interestingly these variables were all significant and with expected signs. Thus, in 2001, the sum of the coefficients associated with the year dummy and the interacted year dummy with the high-tech sector is slightly positive.

To understand the impact of the tax reduction on each group of workers it is necessary to compare the sum of coefficients that include also the interaction terms. From this point of view the results are suggestive. The interaction term of income tax for high-tech is negative, which implies that for this kind of workers the impact of tax reductions is less important when compared to the general case. The opposite is true for low-tech workers, for whom the interaction term is positive – which means that tax reductions are more effective for incentivizing low-tech workers to avoid emigration. These results are valid also for wages: the overall sensitivity of high-tech workers to wages declines when we allow for interactions, while the one of low-tech workers is enhanced.

In Table 15 we summarize the effect of these variables on emigration. An interesting issue is related to the calculation of the amount of the tax reduction for the purpose of simulating the effect of a hypothetical tax reduction on the number of emigrants. Note that since tax reductions analyzed in our paper are permanent, they can be implemented in a limited way: this is so because in the short run tax reductions reduce tax revenues and consequently raise government deficit and debt, which means that their scope is limited; in the long-run, given that in Israel there is a budget deficit reduction law that prevents from increasing the deficit, a permanent tax reduction reduces the size of the government. Thus, permanent tax reductions that are implemented with a parallel reduction in government expenditure, change the political economy equilibrium. In the case of Israel, there was a well-known generalized protest that induced policy-makers to raise back the income and corporate tax rates after 2011, bringing them to the levels that prevailed in April 2007.[14] For the purposes

[14] See Achdut, Spivak and Strawczynski (2013).

of our simulation we only consider the tax reductions implemented until 2007, which reflect of a feasible permanent tax reduction.[15]

Results show that the effect of both wage increases and tax reductions is much higher for low-tech workers than for high-tech ones. This result means that government policy of tax reduction is more effective for low-tech workers, which are quite sensitive to the pecuniary reward. Reducing taxes by an annual amount of 1,000 NIS would reduce the number of low-tech emigrants by 90, which represents approximately 1.5 times the annual emigration flow; for the high-tech sector, such a tax reduction would imply reducing emigration by 14 employees. Note, however, that for the high-tech sector employees, for whom the wage is much higher, actual tax reductions were higher. In fact, using actual tax reductions until 2007, which were 10 times higher for high-tech sector employees, implies an emigration reduction of 140 employees, which is approximately 1.4 times the High-tech annual emigration flow. Still, by looking at the coefficient of the tax effect for a 1,000 NIS tax reduction (fourth line of Table 15), the emigration reduction for low-tech employees is more than 10 times higher than the one for high-tech employees; this result has a policy implication: if the government has a limited budget to be spent on tax reductions, it should be concentrated at the relevant brackets for low-tech workers (3rd and 4th bracket). By doing so the effect on emigration reduction would be intensified.

Table 15

The impact of Tax Reductions on Emigration

	High tech	Low tech	Total
Leaving workers per year	97	61	1,498
Relevant Population[16]	59,584	29,909	919,121
Wages effect (per 1,000 NIS)	-0.0005	-0.002	-0.0007
Tax effect (per 1,000 NIS)	0.00024	0.003	0.0009
The number of employees who would not emigrate for an additional 1,000 NIS of annual salary	30	60	643
The number of employees who would not emigrate for a reduction of 1,000 NIS of annual tax paid	14	90	827

SOURCE: Based on Central Bureau of Statistics Migration and Household income surveys data.

[15] Our calculation assumes that statutory tax rates remain at this level. The amount of the reduction was calibrated according to a monthly wage of 10,000 NIS, which is similar to the wage of low-tech workers who emigrated (see Table 9). According to recently published calculations by the Bank of Israel, further tax increases are needed in order to finance current government obligations.

[16] The relevant population for this calculation is based on the annual pool of high-tech and low-tech workers within the relevant wage brackets according to the annual income survey of 2010.

6. Summary and Conclusions

According to the literature one of the main channels through which labor income taxation affects labor supply choices is via the migration margin. It is surprising, therefore, that only a few studies examined this channel, doing it mainly by looking at ad-hoc income tax reductions: either focusing on special segments of the population (soccer players) or looking at temporary reductions (like the three-year reduction in Denmark). The latter approach, which was primarily driven as a means to overcome identification difficulties, casts some doubt on the external validity of the policy implications that can be drawn from the above studies. In this paper, in contrast, we focus on the permanent income tax reduction that took place in Israel during the period 2004 and 2010, which was relevant for the whole population.

Our findings show that permanent tax reductions have an effect on emigration. After carefully controlling for the alternative net wage that emigrants could earn in the destination countries, we found that the tax reduction implemented in Israel reduced the emigration flows – primarily amongst the low-tech wage earners. A possible explanation for this result is that this type of workers are likely to assign a higher weight to pecuniary aspects (e.g., due to diminishing marginal utility from Income), as compared to unobservable variables like networking or smaller fixed costs in terms of their career. In fact, the fixed effect term in our regressions, which accounts for this factor, is consistent with such an interpretation. A possible direction for future research would be to enrich our model by including proxies for such unobservable characteristics.

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Appendix A – Immigrants Statistics

Table A.1

Immigrants by tax bracket (percent)

	Bracket				
Year	3	4	5	6	7
2000	48.2	30.7	18.5	2.0	0.7
2001	49.3	30.1	18.4	1.6	0.6
2002	51.1	27.8	18.9	1.8	0.4
2003	53.0	27.1	17.7	1.6	0.6
2004	53.2	27.3	17.3	1.7	0.4
2005	52.2	27.8	17.0	2.2	0.7
2006	53.0	26.8	17.1	2.5	0.6
2007	52.1	27.4	17.0	2.8	0.7
2008	51.2	27.1	17.8	3.1	0.8
2009	52.3	27.2	16.9	2.8	0.8
2010	52.1	27.5	16.8	3.0	0.7
Total	51.8	27.6	17.4	2.5	0.7

SOURCE: Based on Central Bureau of Statistics Migration data.

Table A.2

Immigrants by age group (percent)

Year	Age group					
	Up to 24	25-34	35-44	45-54	55-64	65 and above
2000	7.9	37.9	34.7	15.2	3.5	0.8
2001	10.4	31.7	39.5	13.6	3.6	1.3
2002	6.3	31.5	41.0	14.0	6.1	1.1
2003	6.4	33.1	42.2	12.8	4.9	0.6
2004	4.9	37.7	41.3	10.9	3.6	1.6
2005	3.9	41.2	35.8	11.1	6.5	1.5
2006	3.8	36.0	40.5	14.0	5.1	0.6
2007	3.1	37.3	44.2	11.5	3.3	0.7
2008	3.2	37.2	44.6	9.7	4.4	0.9
2009	3.8	33.8	44.9	13.0	4.2	0.4
2010	3.5	33.5	47.6	12.1	2.9	0.4
Total	4.8	35.7	42.0	12.4	4.3	0.9

SOURCE: Based on Central Bureau of Statistics Migration data.

Table A.3

Immigrants by religion (percent)

Year	Jewish	Muslim	Druze	Christian	Others
2000	94.2	1.3	0.1	0.9	3.5
2001	93.0	1.5	0.2	0.9	4.4
2002	92.2	1.6	0.3	1.0	4.9
2003	91.3	2.1	0.5	1.0	5.1
2004	91.1	2.1	0.4	1.0	5.3
2005	91.3	2.0	0.6	1.2	4.9
2006	90.3	2.6	0.6	1.3	5.2
2007	89.8	2.6	0.6	1.3	5.7
2008	89.6	3.1	0.7	1.2	5.4
2009	89.5	3.2	0.7	1.4	5.2
2010	88.9	3.2	0.7	1.3	6.0
Total	90.4	2.6	0.6	1.2	5.2

SOURCE: Based on Central Bureau of Statistics Migration data.

Table A.4

Immigrants' annual wage, mean and quartiles (nominal NIS)

Year	mean	p25	p50	p75
2000	142,871	83,425	113,351	179,808
2001	138,489	82,664	111,398	178,951
2002	137,130	82,701	110,293	176,121
2003	133,575	82,982	108,310	168,920
2004	135,658	82,820	108,174	174,177
2005	135,149	81,709	107,297	171,707
2006	137,300	84,156	108,026	173,285
2007	138,553	84,270	109,133	173,801
2008	145,501	85,603	112,215	181,456
2009	141,992	85,637	111,824	177,415
2010	144,578	86,318	113,060	178,065
Total	140,338	84,706	110,789	176,400

SOURCE: Based on Central Bureau of Statistics Migration data.

Table A.5

Relative monthly wage of immigrants compared to his/her peers

Percentiles	1%	5%	10%	25%	50%	75%	90%	95%	99%	Mean
Wage Ratio	0.6	0.8	0.8	1.0	1.5	2.2	3.2	4.0	6.3	1.8

SOURCE: Based on Central Bureau of Statistics Migration data and Household income surveys data.

Table A.6

Immigrants by work Months (frequency and percent)

year	0 (Business only)	1	2	3	4	5	6	7	8	9	10	11	12	Total
2000	80	99	111	124	141	137	156	163	208	159	192	197	2,668	4,435
	1.8	2.2	2.5	2.8	3.2	3.1	3.5	3.7	4.7	3.6	4.3	4.4	60.2	100.0
2001	87	101	111	140	160	152	164	185	246	210	221	198	3,000	4,975
	1.8	2.0	2.2	2.8	3.2	3.1	3.3	3.7	4.9	4.2	4.4	4.0	60.3	100.0
2002	106	135	111	113	190	146	156	178	207	179	182	205	3,052	4,960
	2.1	2.7	2.2	2.3	3.8	2.9	3.2	3.6	4.2	3.6	3.7	4.1	61.5	100.0
2003	112	141	99	117	149	118	143	153	195	163	178	188	2,914	4,670
	2.4	3.0	2.1	2.5	3.2	2.5	3.1	3.3	4.2	3.5	3.8	4.0	62.4	100.0
2004	151	104	110	115	172	146	155	146	209	165	182	192	3,185	5,032
	3.0	2.1	2.2	2.3	3.4	2.9	3.1	2.9	4.2	3.3	3.6	3.8	63.3	100.0
2005	221	137	137	129	182	136	186	162	223	178	181	229	3,475	5,576
	4.0	2.5	2.5	2.3	3.3	2.4	3.3	2.9	4.0	3.2	3.3	4.1	62.3	100.0
2006	342	142	134	165	197	167	197	192	284	224	266	307	4,713	7,330
	4.7	1.9	1.8	2.3	2.7	2.3	2.7	2.6	3.9	3.1	3.6	4.2	64.3	100.0
2007	428	180	177	191	223	230	207	213	320	279	301	314	5,912	8,975
	4.8	2.0	2.0	2.1	2.5	2.6	2.3	2.4	3.6	3.1	3.4	3.5	65.9	100.0
2008	558	163	179	165	261	225	251	283	349	307	338	436	7,267	10,782
	5.2	1.5	1.7	1.5	2.4	2.1	2.3	2.6	3.2	2.9	3.1	4.0	67.4	100.0
2009	643	183	181	188	270	226	249	280	305	318	362	415	8,202	11,822
	5.4	1.6	1.5	1.6	2.3	1.9	2.1	2.4	2.6	2.7	3.1	3.5	69.4	100.0
2010	854	168	156	234	278	277	292	312	396	408	439	508	10,059	14,381
	5.9	1.2	1.1	1.6	1.9	1.9	2.0	2.2	2.8	2.8	3.1	3.5	70.0	100.0
Total	3,582	1,553	1,506	1,681	2,223	1,960	2,156	2,267	2,942	2,590	2,842	3,189	54,447	82,938
	4.3	1.9	1.8	2.0	2.7	2.4	2.6	2.7	3.6	3.1	3.4	3.9	65.7	100.0

SOURCE: Based on Central Bureau of Statistics Migration data.

Table A.7

Number of Immigrants by technological intensity and multinational company

Year	Hi tec	Low tec	Multinational
2000	14	11	39
2001	13	6	28
2002	14	16	24
2003	22	7	33
2004	27	6	41
2005	35	9	45
2006	37	5	56
2007	24	11	57
2008	106	16	125
2009	10	14	38
2010	11	11	45
Total	313	112	532
Average	28	10	48

SOURCE: Based on Central Bureau of Statistics Migration data.

Appendix B – Propensity Score Matching

In order to perform a dif in dif analysis we performed a propensity score matching (PSM) strategy for comparing individuals of the different brackets with general characteristics that are as similar as possible according to their PSM score. For that purpose we performed regressions that included the following characteristics: age, squared age, technology branch, major branch during the career, affiliation with a multinational company and residence in Dan Region (Tel Aviv and suburbs). Tables B.1 to B.3 show the means for matched and unmatched samples for the different variables.

Table B.1 – Means of matched variables: 4th bracket as treated group

Variable/Bracket	Unmatched		Matched	
	Treated	Control	Treated	Control
Age	36.24	37.25	36.24	36.29
Squared age	1402.2	1474.4	1402.2	1403.4
Technology branch	0.0766	0.118	0.0766	0.0756
Major branch during the career	58.028	61.92	58.028	57.96
Multinational Company	0.065	0.139	0.065	0.064
Dan Region	0.224	0.228	0.224	0.221

Table B.2 – Means of matched variables: 5th bracket as treated group

Variable/Bracket	Unmatched		Matched	
	Treated	Control	Treated	Control
Age	36.24	40.58	36.24	37.09
Squared age	1402.2	1746.3	1402.2	1472.2
Technology branch	0.0766	0.166	0.0766	0.0799
Major branch during the career	58.028	64.26	58.028	56.36
Multinational Company	0.065	0.17	0.065	0.062
Dan Region	0.224	0.205	0.224	0.211

Table B.3 – Means of matched variables: 6th bracket as treated group

Variable/Bracket	Unmatched		Matched	
	Treated	Control	Treated	Control
Age	36.24	43.24	36.24	37.27
Squared age	1402.2	1958.8	1402.2	1492.1
Technology branch	0.0766	0.104	0.0766	0.060
Major branch during the career	58.028	68.22	58.028	57.20
Multinational Company	0.065	0.24	0.065	0.058
Dan Region	0.224	0.173	0.224	0.226