

CHAPTER 9

Issues In Environmental Policy

- ◆ Economic incentives are an increasingly important component of environmental policy in many countries. The use of such incentives can be expanded in Israel as well, which would contribute to both the achievement of environmental objectives and the integration of Israel within global environmental trends.
- ◆ This chapter discusses the possibility of expanding the use of economic incentives in Israel in three areas: waste disposal, the number of private vehicles and their usage and increasing building density as part of planning policy.
- ◆ Israel lags far behind other developed countries in the area of waste disposal. About 87 percent of the waste in Israel goes to landfill, which is the worst solution from an environmental perspective. Israel has recently adopted a policy to reduce the share of landfill, including a landfill tax and the transfer of responsibility to the producer, which provides local authorities and producers with incentives to recycle and to reduce landfill.
- ◆ An econometric analysis shows that increasing the excise tax on gasoline together with reducing the purchase tax on new vehicles would reduce the mileage of private vehicles and thus improve the quality of the environment without reducing tax revenues.
- ◆ The proportion of low-density buildings in densely populated districts has not declined in recent years and in districts with an intermediate population density it has even increased.

1. INTRODUCTION

The increasing global awareness of environmental issues is reflected in the policies being implemented in various countries, in the efforts to expand and upgrade these policies and in the attempts to formulate comprehensive and binding international agreements on environmental issues. One prominent example is the Copenhagen Conference on climate change which took place this year.

The advancement of environmental policy is particularly important in Israel which is a small and crowded country with a relatively high standard of living and a higher rate

The advancement of environmental policy is particularly important in Israel.

Regulation and economic incentives are two main types of environmental policy.

Quantity regulation serves as an environmental policy tool in many areas.

of population growth than other developed countries.¹ This is in addition to the need to become part of international processes and agreements that are placing increasing emphasis on environmental issues. This has been demonstrated recently in the proposal made by Israel at the Copenhagen Conference to limit growth in the emission of greenhouse gases in Israel. This has even greater relevance in view of Israel's process of accession to the OECD, which attributes high priority to environmental issues and policy.²

This chapter distinguishes between two main types of environmental policy: regulation and economic incentives,³ with the focus on the latter. The discussion presents examples of economic incentives that have already been implemented in Israel. Following that, the use of economic incentives in the areas of waste disposal, use of private vehicles and building density is discussed in greater detail.

Quantity Regulation – legislation and regulations which limit the scope of activities that are detrimental to the environment. Examples include: limiting or even totally prohibiting the emission of pollutants into the atmosphere, the water or the ground and the use of certain substances or their inclusion in products; prohibition of private vehicle entry into certain areas or at certain times; restrictions on picking wild flowers and hunting; restrictions on the abstraction of water, etc. Planning and building policy is a particularly important type of quantity regulation, which is used by the authorities to determine where and to what extent it is permitted to build, as well as other restrictions on land use (nature reserves, quarries, landfills, etc.).

Quantity regulation directly determines permitted quantities and does not depend on market mechanisms to achieve its goals.⁴ Its advantage is the ability of policy makers to set quantities with a high degree of accuracy, which becomes particularly important when trying to achieve a specific limit or when spatial dispersion is relevant (such as in the case of residential building or the emission of dangerous substances). On the other hand, regulation has a number of disadvantages and is practical in only some cases. These include:

- **Measurability** – Quantity regulation is appropriate in cases where the activity or the emissions that each individual or producer produces is measurable and cases in which the costs of monitoring and enforcement are not prohibitively high. Thus, for example, it is appropriate for determining caps on the emissions of large factories but not for determining caps on the emissions of a private

¹ For further discussion of environmental policy, see Chapter 8 of the 2008 Bank of Israel Annual Report. For an international comparison using a number of environmental indicators, see The Little Green Data Book 2009, World Bank (2009). A large number of environmental indicators appear in a special publication of the Central Bureau of Statistics entitled Environmental Data Compendium 2006.

² See, for example, OECD Environmental Outlook to 2030, OECD (2008).

³ Environmental policy can involve other measures, such as increasing public awareness through education and dissemination of information. Their contribution can be significant but is beyond the scope of this discussion.

⁴ Nevertheless, quantity regulation is in general based on fines imposed on violators. The decision whether to disobey the law and thus risk a fine is partly determined by the size of the fine and in this sense the fine is an economic incentive.

vehicle. Although in theory one could measure the amount of household waste produced by each family, the cost of monitoring would be very high and therefore other methods are required in order to enforce limits.

- Inherent rigidity – Even if it is possible to measure quantities, it is not possible in many cases to set limits that take into account differences between individuals or between producers. For example, setting a uniform cap on emissions for all individuals does not take into account their different needs and tastes for use of a private vehicle.

Economic incentives – These are intended to alter the behavior of individuals or producers. There are two advantages shared by all types of economic incentives:

- Flexibility in the effect on producers and consumers—Consumers vary with respect to preferences and needs, as do producers with respect to their products and the technologies they use. It is difficult to take this variation into account in setting quantitative limits and in fine-tuning the limit to the unique characteristics of each. In contrast to quantity regulation, economic incentives do not set a rigid quantitative limit for the individual consumer or producer. Rather, they preserve the flexibility to choose the quantity produced, based on the market mechanism. Thus, for example, they make it possible to reduce the total emission of pollutants by a certain proportion without imposing a uniform rate of reduction on all producers.
- Global trends—The current environmental policy in a large number of countries emphasizes the use of economic incentives. This trend is particularly evident in the case of the OECD, especially with regard to the principle of “the polluter pays”. This is relevant to Israel which is in the process of accession to the OECD. It is possible that Israel will in the future be required to adopt environmental taxes (such as carbon taxes) as part of international agreements for the reduction of greenhouse gases or in order to avoid protective tariffs that will be imposed on imports from countries that do not accept emission limits.

There are two main types of economic incentives:

a. Taxes and subsidies – These are the primary economic incentives currently used to implement environmental policy. Their goal is to alter the relative price of consumption or production patterns in order to induce consumers or producers to reduce activities that are detrimental to the environment or to encourage activities that contribute to it. They are based on the understanding that certain consumption and production patterns are characterized by externalities that are not reflected in the market prices faced by a consumer or producer. In the case of a negative externality, either the price of the product to the consumer or the cost of production to the producer should be raised (by means of taxation). In the case of a positive externality, the consumer price or cost of production should be reduced (through subsidies). In addition to the advantages mentioned above, green taxes also provide the following advantages:

- Measurement, monitoring and enforcement – In contrast to quantitative limits,

Economic incentives have several advantages as environmental policy tools.

“Green” taxes are intended to increase the price of activities detrimental to the environment, and thereby to reduce them.

the imposition of a tax in some cases can reduce the damage to the environment even when it is difficult to measure the damage caused by each individual. In addition, it is likely to save a significant portion of monitoring and enforcement costs. Thus, for example, it is difficult to measure the total pollution from each vehicle;⁵ nevertheless, raising the cost of using a private vehicle (through the taxation of gasoline and parking or congestion charges) will reduce its usage. As described below, it is not practical to set a quota for the waste that each household can produce; however, raising the price of landfill paid by the local authorities is likely to eventually reduce the use of landfill. Clearly, there are cases in which taxation requires measurement and monitoring, such as the taxation of the actual emissions of a particular pollutant (as opposed to the taxation of gasoline or a raw material that contains the pollutant), which requires measurement at the factory's smokestack. These considerations are also valid with respect to environmental subsidies, such as in the case of public transportation, alternative energy and R&D.

- Fiscal advantages – Green taxes do not involve economic distortions; on the contrary, they repair distortions created by market failures. Thus, they can serve as a desirable substitute for distortionary taxes (such as income and consumption taxes). In contrast, environmental subsidies have a fiscal cost. Nonetheless, the main goal of green taxes is clearly to generate behavioral change. If they increase tax revenues without bringing about such change, their goal has not been achieved.

Despite their advantages, the effectiveness of taxes and subsidies is limited to cases in which the change in relative prices has a real effect on behavior. In cases where there is little effect (such as in the case of inelastic demand), the use of these economic incentives will not achieve the desired results or will require excessive rates of taxation or subsidization. In these circumstances, quantity regulation is preferable.

Concern is often voiced that green taxes will increase production costs and thus will reduce exporters' competitiveness and the level of economic activity. This concern cannot be ignored but it is worth mentioning several points: a) Quantity regulation, which limits emissions or the use of certain raw materials, is likely to also increase production costs since it will result in the transition to more expensive production methods or inputs. b) In the long term, there is a possibility that other countries will impose protective tariffs on imports from countries that do not introduce green taxes, which will reduce their competitiveness. c) The revenues from green taxes make it possible, as mentioned, to reduce other taxes that affect competitiveness and the level of economic activity. d) The imposition of green taxes is often consistent with an improvement in competitiveness and greater economic efficiency. Thus, for example,

⁵ Total pollution is the product of pollution per kilometer and mileage. The existing mechanisms in Israel and world wide are limited to the measurement and taxation of pollution per kilometer and are only possible at a particular point in time (for example, at the time of the purchase of a vehicle or annual vehicle licensing).

taxes on energy and on the use of private vehicles may help to achieve greater efficiency in the transportation and energy sectors, in addition to their environmental contribution.

b. Tradable permits – The use of this policy tool is still rather limited worldwide but may expand in the future. This framework involves trading in the rights to emit greenhouse gases, though the mechanism can also be applied to other pollutants. Although each producer is given a quota for emissions, a producer who is interested in exceeding it can do so by purchasing rights from another producer who emits less than his allocation. This creates a better allocation of emissions among producers in accordance with their characteristics. Clearly, this mechanism is limited to situations in which emissions are measurable and it requires monitoring systems, as in the case of quantity regulation. In addition, the transaction costs of such trade may be high.

Quantity regulation and economic incentives are in fact complementary and environmental policy requires both. This is because each has advantages and disadvantages and their appropriateness varies from one situation to the next. In some cases they complement each other. Thus, for example, the imposition of taxation on low-density building may dovetail with a planning policy that seeks to limit the use of land. Graduated prices for water and electricity are an example of combining quantity regulation and taxation.⁶ The expansion of the public transportation system is a complementary and necessary measure when raising the cost of private vehicle use.

These policy tools are meant to influence not only consumption and production carried out using existing methods, but also to encourage the adoption of cleaner production methods and the development of products that contain less polluting material and production technologies that involve less consumption of energy and raw materials and a lower level of emissions.

Environmental policy in Israel has focused more on quantity regulation until now⁷ and less on economic incentives. However, there has been increasing use in recent years of economic incentives and a not insignificant number of these measures are presently in various stages of assessment or legislation. Those already in place (which may not necessarily have been adopted out of environmental considerations) include the taxation of gasoline, the bottle deposit law, the landfill tax, the price of water and the sewage levy. Recently, a number of new economic incentives have been introduced: monetary incentives for the production of solar energy and for the disposal of old cars, differential rates of purchase tax on new cars according to their level of emissions and a reduced purchase tax on hybrid cars.

Despite the progress made, there is room for significant expansion of economic incentives in order to achieve environmental objectives in Israel. These can include,

⁶ Graduated prices also make it possible to reduce the regressive aspect of green taxes (i.e., the incidence on the weaker segments of the population) in these contexts.

⁷ This includes the imposition of fines which, as mentioned, can be viewed as a type of economic incentive. In a number of recent cases, the courts have imposed heavy fines for environmental violations, such as sewage discharge and contamination of land and the sea.

Environmental policy requires both quantity regulation and economic incentives.

Environmental policy in Israel in the past focused on quantity regulation; in recent years, however, there has been increasing use of economic incentives.

There is room for significant expansion of economic incentives in order to achieve environmental objectives in Israel.

among others: increasing the price of using a private vehicle⁸ and of energy in general; a consistent policy in the area of water pricing; and the taxation of packaging. The taxation of carbon emissions is expected to receive increasing attention worldwide in coming years and Israel will need to be part of this trend. Its heavy use of coal in the production of electricity constitutes a major challenge in this context.

The following sections contain a discussion of the use of economic incentives, and the possibility of expanding their use, in three environmental contexts: waste disposal and the landfill tax in view of the high rate of landfill use and the effects it has; the effect of economic incentives on the number of private vehicles and their usage; and the possibility of introducing economic incentives with regard to building density, as a complementary tool to planning policy.

2. WASTE DISPOSAL AND THE LANDFILL TAX

The methods of waste disposal in Israel lag significantly behind those in other developed countries. This is reflected in the massive use of landfill, which involves both environmental and economic damage. The problem has worsened with the uninterrupted growth in the amount of waste produced while the supply of landfill sites dwindles, particularly in the Central district and the North. The landfill tax is the main policy measure introduced to deal with this problem in recent years and can be expected to dominate in the future. It constitutes an economic incentive for local authorities to reduce the amount of waste arriving at landfills, either by lowering the amount of waste produced and/or recycling it. The most widely used and effective method of recycling is the separation of waste at the household level. The analysis below shows that the tax is expected to have somewhat of an effect on the use of landfill, particularly because the revenues from the tax are used to subsidize the transition from landfill to recycling. However, in order to achieve substantial change, additional measures will apparently be needed.

a. The current situation

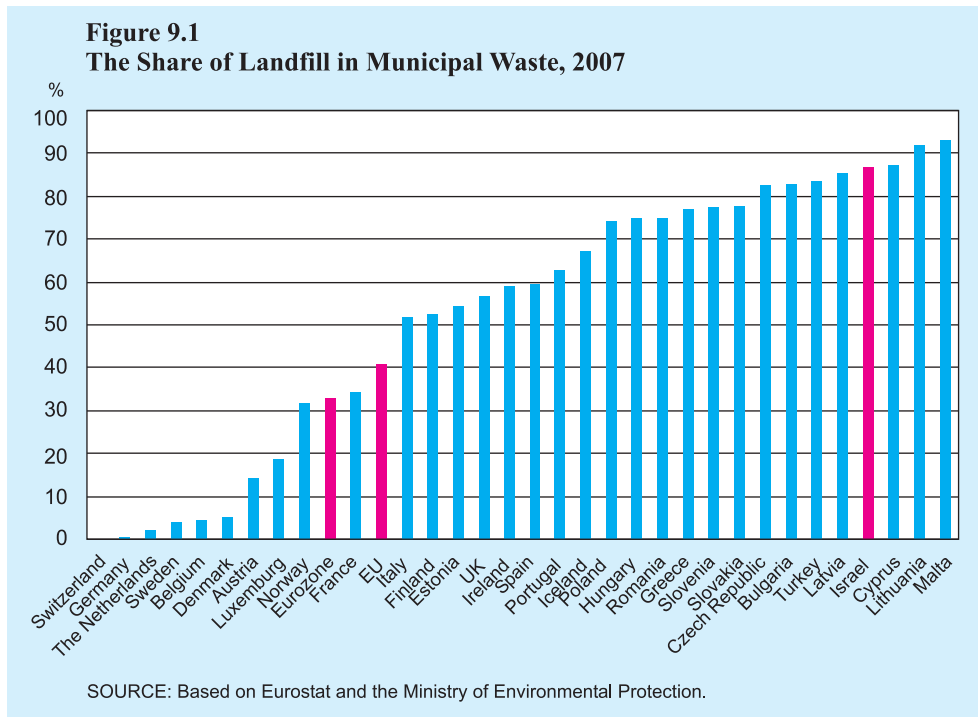
Waste disposal is one of the areas in which Israel lags far behind other countries. About 87 percent of the municipal waste in Israel is sent to landfill, the worst solution from an environmental and even economic perspective. This compares to about 40 percent on average in the EU and only a few percent in countries such as Belgium, Denmark, Holland and Sweden.

About 87 percent of the municipal waste in Israel is sent to landfill, one of the highest rates compared with those in other countries.

⁸ There are a wide variety of economic incentives that can be used to reduce the use of private vehicles. Several of them are discussed in Chapter 8 of the 2008 Bank of Israel Annual Report, including taxation of parking at the workplace and cashing out free parking, as well as the elimination of distortions in the taxation of company cars which encourage the use of private vehicles. The distortive effect of the salary component for vehicle maintenance, which exists primarily in the public sector, is discussed in Recent Economic Developments 121, Bank of Israel, June 2008, pp. 30–34.

There are a number of environmental and economic problems that result from the growing quantity of waste and the lack of proper waste treatment, including the allocation of land to landfill, the high costs of transporting the waste and pollution of air, land and water, the emission of greenhouse gases and the waste of resources. On the other hand, households face a negligible marginal price for producing waste and therefore have no immediate incentive to reduce the amount of waste they produce or

Landfill incurs many external costs, while the marginal cost of producing waste is negligible.



to recycle it. Furthermore, the policy currently adopted by Israel actually leads to a higher cost of recycling (in terms of time and effort).⁹

There are many alternatives to landfill: reducing the amount of waste produced, re-use, recycling of dry waste (paper, plastic, glass, etc.), the production of compost from wet (organic) waste and even the production of energy. All of these options are environmentally preferable to landfill, even if they are more expensive and require the cooperation of several entities, i.e., producers, households, local authorities, recycling factories, etc. The interdependence of the various entities in the chain of waste treatment, together with the high costs of transition and the uncertainty of its success, constitute a critical barrier to the transition from the present equilibrium to

Local authorities do not recycle waste, because of the high initial investment required, uncertainty, and high operating costs.

⁹ In order to recycle, a household needs to bring each type of waste to a different drop-off point, which is sometimes not easily accessible. In addition, there is no infrastructure for the recycling of organic waste.

one that includes an active recycling market. Thus, for example, a study by Lavee¹⁰ showed that it would be economically worthwhile for 51 percent of local authorities to recycle dry waste but that the majority have chosen not to, due to the fluctuations in demand for recycled material which makes long-term planning difficult.

As a result, the public policy needed to bring about substantial change must provide a solution to the many barriers to transition, starting with the high costs of transition and the high operating costs involved and ending with the elimination of uncertainty regarding the success of the move among all participants and the creation of mechanisms for coordination between them.

b. Main policy measures

In recent years, the Ministry of Environmental Protection has worked to rationalize the use of landfills and to raise the price local authorities face. Thus, during the 1990s, municipal landfill sites were closed in favor of central landfills. The main goal of the change was to prevent the pollution of land and water; however, it also led to increased costs of transportation and waste disposal. A landfill tax was introduced in 2007 with the direct objective of reducing the amount of waste going to landfills. In 2009, the tax stood at NIS 30 per ton and will be increasing to NIS 50 in 2011 (at 2007 prices).¹¹ The tax represents about 12 percent of the average cost of waste disposal and less than one percent of the total expenditure of local authorities.

The revenues from the tax are deposited in a special fund of the Ministry of Environmental Protection which is used to support the change in the waste disposal process through surveys and planning, education and the dissemination of information, the creation of waste-gathering infrastructure and the establishment of recycling factories.¹² Thus, the revenues from the tax are essentially used for subsidization, thus doubling the government incentive and reducing the barrier due to transition costs. At the same time, the government retains the flexibility to allocate the funds according to an overall view of the barriers.

Another method of encouraging recycling is to introduce the principle of producer responsibility, according to which producers and importers are responsible for the amount of waste they introduce into the market and also for the recycling of a certain percentage of it. This principle has been implemented for tires and bottles and is expected for packaging as well. This measure has been effective in raising the rate of recycling for bottles, which increased from 30 to 60 percent after the deposit law went into effect.

¹⁰ Doron Lavee (2007). "Is Municipal Solid Waste Recycling Economically Efficient?", *Environmental Management* 40, Number 6, December.

¹¹ The size of the tax is determined according to an estimate of the externalities involved in landfill. Increasing the tax is currently being discussed as a way of bringing about a substantial change in behavior.

¹² In 2008, for example, NIS 39 million were transferred to 129 local authorities for the planning and implementation of recycling projects.

In 2007 a landfill tax was introduced, which is scheduled to reach NIS 50 a ton in 2011.

The revenues from the tax are deposited in a special fund used to support the change in the waste disposal process.

c. The options facing local authorities

The landfill tax does not force local authorities to take action but rather provides them with an incentive to reduce the amount of waste produced, with priority given to waste separation at the household level through the recycling fund. Thus, local authorities can deal with the tax in a number of ways, which can be divided into four main categories:

1. **Maintaining the status quo:** The local authorities can absorb the increased cost of landfill and decide not to take any active measures to deal with waste. This policy makes sense as long as the landfill tax is small and the other barriers are significant. This is particularly the case for small towns whose transition costs and operating costs for recycling are high as a result of economies of scale (see Lavee, footnote 10).

2. **Expansion of existing facilities:** The existing recycling system is based on drop-off points for dry waste. The improvement of this system through additional drop-off points, education and dissemination of information among the public can bring about an increase in the rate of recycling for this type of waste. However, organic waste, which constitutes about 40 percent of the total, will continue to be sent to landfill together with the other types of waste.¹³

3. **Changing the system for garbage pickup:** separation of waste at source (i.e., at the household level) into a number of components that will be picked up from separate receptacles. This is the most widely used and effective method since it is the most convenient for households and facilitates the production of high-quality raw materials. (Wet and dry waste are not mixed.) This change is complicated and costly for the local authorities but is the only system for recycling organic waste, which is the main component of waste and the most environmentally problematic when used in landfill. Therefore, the Ministry of Environmental Protection has made it a top priority to subsidize these programs. The success of this policy will be judged by its ability to persuade local authorities to invest in the infrastructure for waste separation at source.

4. **Differential payment according to amount of waste:** a widely-used method in many locations worldwide, which involves charging a household according to the quantity of waste it produces. In theory, this is the most appropriate solution since the consumer faces the real price of producing waste. In reality, the system is complicated from an administrative point of view and even creates an incentive to dump waste illegally.

Complete recycling of waste will be possible only after investment in the infrastructure for separation of waste at source.

¹³ The potential use of organic waste for producing high-quality compost increases significantly with the separation of glass and plastic.

d. The effect of the landfill tax

Numerous studies worldwide have found that various economic incentives have a major influence on the amount of waste produced and the rates of recycling.¹⁴ Most of the studies have focused on direct incentives to the household rather than incentives to local authorities. A number of studies have dealt with the effect of a landfill tax:

The Ministry of Environmental Protection carried out a comparison of the rate of landfill and the size of the tax in nine European countries.¹⁵ It appears that the landfill tax is widely used in the developed countries. Its average size is about 40 euros per ton, which represents about 50 percent of the total cost of waste disposal. In addition, it was found that the landfill tax and the price of landfill are negatively correlated with the rate of landfill. Thus, the elasticity of demand with respect to the size of the tax was estimated at -0.9 . However, it should be remembered that in all the countries in which the landfill tax was imposed, a variety of additional measures were adopted to deal with waste. A similar survey by the IES¹⁶ showed that the effect of a landfill tax is dependent in general on the overall policy for minimizing landfill disposal and that this effect is significant only if the tax is very high.

A study done in the US¹⁷ estimated the elasticity of demand for landfill with respect to its price using administrative data for Metropolitan Portland where the price of landfill was raised from \$14 per ton in 1984 to \$62 per ton in 1991. The study found the elasticity of demand to be -0.45 . However, the researchers attributed this elasticity to the direct effect on the consumer since the research was carried out on a competitive waste disposal market and therefore assumed that the price is passed on to the household.

Another study, which was carried out in Holland,¹⁸ compared the effect of the landfill tax on households that do not pay it directly and on firms that do. It was found that firms were sensitive to changes in price while households were not. Nonetheless, it is important to recall that the proportion of municipal waste going to landfill was already very low even before the introduction of the landfill tax, especially relative to the situation in Israel.

It is difficult to know how relevant the results of these studies are to Israel. Thus, marginal prices do not trickle down to households in Israel and therefore it is possible that the elasticity is lower here. The estimates presented above may be relevant to Israel if municipal authorities shift the cost of landfill on to the household. This is done through either setting a differential price for garbage pickup or by lowering the

¹⁴ For a survey of studies on the effect of economic incentives on household behavior, see Household Behavior and the Environment: Reviewing the Evidence, 2008, OECD.

¹⁵ Tal Shohat and Tanya Klinov (2005), "The Landfill Tax". Ministry of Environmental Protection – Branch for Solid Waste.

¹⁶ Institute for Environmental Studies.

¹⁷ James G. Strathman, Anthony M. Rufolo and Gerard C.S. Mildner (1995) "The Demand for Solid Waste Disposal", Land Economics 71, No. 1 (February), 57–64.

¹⁸ B. Heleen and L. Vincent (2006). "Effective landfill taxation: a case study for the Netherlands", Institute for Environmental Studies.

The effect of a landfill tax is dependent in general on an overall policy for minimizing landfill disposal and this effect is significant only if the tax is very high.

cost of waste separation in terms of time and effort (by increasing the number of pick-up points or by encouraging separation at source).

According to the elasticity estimated in the US study, the landfill tax will lead to a reduction of only about 10 percent in landfill.¹⁹ According to the simple correlation obtained in the study by the Ministry of Environmental Protection, the effect of the landfill tax may be up to 20 percent, which means that the percentage of municipal waste that is expected to go to landfill is between 66 and 76 percent. Similar estimates were obtained in the study by Lavee and Regev,²⁰ which used data of the municipal governments in Israel to calculate the cost of recycling relative to the cost of landfill.

The various estimates indicate that even according to the most optimistic results, the rate of landfill in Israel is expected to remain high relative to other developed countries. It appears that government intervention on a larger scale is needed, whether by increasing the landfill tax/subsidization or by means of complementary policy measures that will overcome existing barriers. According to Lavee and Regev, the main barrier is the volatility in the prices of recycled goods, as a result of which local authorities that tried to introduce recycling could not meet the price for pickup demanded by the operators. As a result, many were forced to stop recycling and to absorb the cost of changing back to the old system. The study estimated the additional cost of this uncertainty to be in the vicinity of NIS 50 per ton of waste, an additional cost that makes recycling unfeasible for most local authorities.²¹ Thus, it is recommended that a system of government insurance be created for the prices of recycled goods. According to Lavee and Regev, insurance can achieve the desired goal with a much lower economic cost than a landfill tax. Another possible measure is to set a normative rate of recycling for local authorities according to a cost-benefit analysis (which will, in particular, be based on the size of the local authority and its geographic area) and to introduce a high tax on deviations from it. This measure will be more equitable with respect to local authorities that contribute only a marginal proportion of total waste and are unable to take a major role in catalyzing the process. This solution will thus be more effective due to the high marginal cost of deviating from the target.

¹⁹ The addition to the price of landfill was calculated as the proportion of the landfill tax in the total price of landfill multiplied by two since the revenues from the tax are returned to local authorities for projects to reduce landfill.

²⁰ Doron Lavee and Uri Regev (2009), "An alternative solution to the landfill tax for waste disposal in Israel", *Israel Economic Review* 56, Volume 1, March.

²¹ The article estimates the risk premium needed to compensate the local authorities for these fluctuations on the basis of the variance in the prices of various materials and its effect on the rate of recycling of those materials.

3. THE EFFECT OF POLICY MEASURES ON THE NUMBER OF PRIVATE VEHICLES AND THEIR USAGE

a. Background

The reduction in use (mileage) and number of private vehicles will help to alleviate the congestion on roads and will also improve the quality of the environment. Therefore, we have considered the effect of various policy measures (taxes) on the number of private vehicles and their usage. We assume that when policy measures reduce the use of private vehicles, there will be a corresponding increase in the use of public transportation and therefore there will be almost no effect on economic activity. Public transportation is more energy-efficient and therefore this policy also contributes to improving the quality of the environment. The policy measures examined (by means of an econometric model) were the purchase tax on new private vehicles and the excise tax on gasoline.

b. A comparison of policy measures between Israel and Western Europe

The component of taxes in the purchase price of a private vehicle in Israel is currently higher than in most Western European countries. The rate of taxation on a new private vehicle was about 61 percent of the consumer price in 2008 and even rose on average in 2009 as a result of the green tax reform.²² In contrast, the component of taxation in the price of 95-octane gasoline is similar to both the median and the average in Western European countries.²³ Thus, the tax rate on 95-octane gasoline was about 57 percent of the price of gasoline at the pump at the beginning of 2010.²⁴ On the other hand, it is unclear whether the rate of taxation on gasoline and private vehicles in other countries is optimal and furthermore there is significant variation among countries. There was an upward trend in the rate of taxation on gasoline in the OECD between 2002 and 2007.²⁵

c. The model

The model assumes that the individual faces a two-stage decision: In the first stage, he chooses whether to purchase a private vehicle. If he decides to do so, then in the second stage he chooses which type of transportation to use. The decisions take

The component of taxes in the purchase price of a private vehicle in Israel is currently higher than in most Western European countries. In contrast, the component of taxation in the price of 95-octane gasoline is similar to both the median and the average in Western European countries.

²² The analysis assumes that the average CIF price of a private vehicle, on which purchase tax is added, is NIS 50 thousand. In addition, a sales markup of 25 percent is added to this and VAT is calculated on the total.

²³ According to the 2008 Annual Report of the State Revenue Authority (Chapter 13 – Excise Tax on Gasoline) and taking into consideration the 0.3 NIS increase in the excise tax on gasoline in 2009.

²⁴ The analysis was carried out at the beginning of 2010 and assumed that the price of 95-octane gasoline was NIS 6.30 and that the sales markup is about 0.6 NIS. The rate of taxation varies with the price of gasoline.

²⁵ OECD Environmental Outlook to 2030, OECD 2008.

into consideration fixed costs, variable costs and the alternatives offered by public transportation (in terms of price, quantity and quality).

We expected that the price of a private vehicle (the average price lagged by one and two quarters) will affect the total number of private vehicles.²⁶ The price of a private vehicle includes a large taxation component, which includes both the purchase tax and VAT. Using this variable, we estimated the effect of the rate of vehicle taxation on the total number of vehicles. We also expected that the price of gasoline will affect the total number of vehicles to some extent. Per capita GDP (standard of living) was used as a control variable.

We expected that the average mileage of a private vehicle (number of kilometers traveled per quarter)²⁷ will be affected by the consumer price of gasoline,²⁸ the inverse of congestion on the roads—the capital invested in roads divided by the number of vehicles and the quality of bus and railway services. Quality of public transportation is measured by a number of indexes: a) the per capita supply of these services (an index of per capita bus-kilometers in the case of buses and indexes that reflect the supply of railway cars in the case of trains);²⁹ b) the real accumulated investment in the railways, which is a good approximation for the capital stock in trains and track, and an index of the level of railway development. The control variables in this equation include per capita GDP, indexes of the use of public transportation, the revenues from railway and bus services in constant prices,³⁰ indexes of public transportation ticket prices in constant prices and the security situation as represented by the number of Israeli victims of terrorist acts. We assume that if an increase in the price of gasoline reduces the average mileage of a private vehicle, there will be a parallel increase in the demand for public transportation.

d. Results

Two equations were simultaneously estimated using the SUR method, which assumes that there is correlation between the residuals of the regressions. The first equation explains the change in the number of private vehicles and the second explains the

Two equations were estimated simultaneously using the SUR method. The first equation explains the change in the number of private vehicles and the second, the in average private vehicle mileage.

²⁶ The Central Bureau of Statistics data on total private vehicles is in annual terms. The data were translated into quarterly terms using the foreign trade data on the import of vehicles in constant prices.

²⁷ The average quarterly mileage of a private vehicle was calculated according to annual data published by the Central Bureau of Statistics. In order to translate the data into quarterly terms, we utilized quarterly national accounts data on gasoline consumption by private vehicles in constant prices, which neutralizes the effect of changes in the price of gasoline.

²⁸ We only took into account the price of 95-octane gasoline since it is used by almost all private vehicles.

²⁹ Although it would have been preferable for the indexes of the quality of public transportation to include, apart from measures of quality, the punctuality of service and whether its distribution is optimal, these types of indexes do not exist for the long term.

³⁰ The results were unchanged when the regression was run without indexes of public transportation revenues in constant prices.

change in the average mileage of a private vehicle.³¹ The equations were estimated using quarterly changes during the period from the fourth quarter of 1995 until the first quarter of 2009 - the last quarter for which data was available.

Table 9.1
The Effect of Policy Measures (Compared with Previous Situation)

Policy measures	Difference in number of private cars ^a	Change in average mileage (km) ^b	Change in total mileage (million km) ^c	Change in tax revenues ^d	Effect on transport efficiency ^e
1. Reduction in price of car (percent)	1,103 *	No effect ^f	19*	-166 *	Positive, low
2. Increase in price of fuel (percent)	0	-31	-57**	178**	Positive, medium
3. Combined policy	0	No effect ^f	-37**	0	Positive, medium

^a At the end of 2008 there were 1.9 million private vehicles.

^b The average mileage per private vehicle is 17,000 km a year.

^c Total private vehicle mileage in 2008 was 30,448 million km.

^d Tax revenues are based on tax year 2008.

^e Assuming that a reduction in average private vehicle mileage serves to increase demand for public transport.

^f Assuming that a change in the total number of private vehicles does not affect average private vehicle mileage.

^g A reduction in purchase tax that reduced the purchase price of a vehicle was reduced by 1.07 percent, and an increase in excise duty that increased the price of fuel by 1 percent would leave total tax revenue unchanged.

SOURCE: Bank of Israel.

We examined the effect of a change in the tax on gasoline combined with a change in the purchase tax rate on new vehicles and in particular when there is no net change in total tax revenue as a result. Our goal is to determine whether this policy reduces the use of private vehicles. According to the regression, reducing the purchase tax on vehicles and simultaneously raising the tax on gasoline indeed leads to a decline in mileage. It can be assumed that the decline in the use of private vehicles simultaneously increases the use of public transportation, decreases congestion on the roads and works to increase the quality of the environment.³²

It was found that a purchase tax is, as expected, negatively correlated with the total number of private vehicles. Reducing the rate of taxation on private vehicles, such that the price to the consumer declines by one percent, will lead to a small increase of

³¹ We also estimated the model using OLS with no substantial change in the results. In particular, there was no change with respect to the policy variables considered, which is an indication of the robustness of the estimates.

³² There are alternative perspectives, such as the efficiency of the tax system. While a tax is defined as efficient from the point of view of the tax system if it does not alter behavior, we are in fact interested in changes in behavior.

Purchase tax is, as expected, negatively correlated with the total number of private vehicles.

about 1,100 private vehicles (the total number of vehicles at the end of 2008 was 1.9 million). The total mileage of a private vehicle will increase, but only somewhat.

It was found that an increase in the tax on gasoline leads to a decline in average mileage, as expected. An increase in the tax on gasoline that raises the consumer price of 95-octane gasoline by one percent will result in a decrease in annual mileage of 31 kilometers, where the average annual mileage per private vehicle is 17 thousand kilometers. Although this is not a substantial decline, the effect is larger than that of an increase in the purchase tax.

A policy measure that includes an increase in the tax on gasoline by one percent and a simultaneous reduction of the purchase tax on new vehicles by 1.07 percent³³ will lead to a decrease in the mileage of private vehicles by 37 million kilometers (out of a total of 30,448 million kilometers in 2008). Tax revenues remain unchanged as a result of this alteration in the tax mix. It is worth mentioning that, according to the regression results, public transportation ticket prices do not influence the total mileage of private vehicles.³⁴ This finding suggests that, given the public transportation prices which prevailed from 1995 to 2009, the choice of whether to use a private vehicle or public transportation was not influenced by the level of those prices but rather by the quality of the public transportation option.³⁵

e. Policy conclusions

This section has examined the effect of policy measures in reducing the mileage of private vehicles with the goal of reducing congestion on the roads and improving the quality of the environment. The regression results show that from the point of view of transportation efficiency and quality of the environment, it is worthwhile reducing the tax on the purchase of new vehicles while increasing the operating costs of a private vehicle through an increase in the tax on gasoline. According to the results, raising the tax on gasoline will reduce the mileage of private vehicles more than an increase in the purchase tax. The reduction in the purchase tax on private vehicles is likely to have other positive externalities that were not estimated, such as the transition to newer vehicles which are safer and less polluting.

When considering a change in the tax mix on the vehicle market, account should be taken of the fact that while the state of the roads in Israel is close to that in Western Europe, the public transportation system, primarily in the metropolitan areas, lags

Tax on gasoline leads to a decline in average mileage, as expected.

A policy that includes an increase in the tax on gasoline and a simultaneous reduction of the purchase tax on new vehicles will lead, based on the regression, to a decrease in the mileage of private vehicles.

From the point of view of transportation efficiency and quality of the environment, it is worthwhile reducing the tax on the purchase of new vehicles while increasing the tax on gasoline.

³³ It is not the intention of the proposed policy measure to change VAT but rather to change the tax on gasoline and the purchase tax on new vehicles.

³⁴ It may not be possible to estimate the effect of ticket prices on average mileage due to the insufficient variation in prices over time.

³⁵ We have considered the effect of a relatively small change in the prices of vehicles and gasoline. It is possible that larger changes would have a non-linear effect on mileage and on total number of vehicles. Therefore, it appears that the estimated effect, given the existing prices of vehicles and gasoline, is a lower bound. Larger changes in prices will apparently have a greater effect.

It is more worthwhile to improve the frequency and distribution of public transportation than to reduce ticket prices.

significantly behind those in Western Europe.³⁶ If it is decided to encourage public transportation using the tax system, then it would be worthwhile improving the quality of public transportation.

With respect to public transportation, the alternative to private vehicles, the regression results indicate that it is worthwhile improving the supply of public transportation (i.e. frequency and distribution) rather than reducing ticket prices.

4. MORE EFFICIENT USE OF RESIDENTIAL LAND AND THE USE OF PLANNING POLICY TO IMPROVE ENVIRONMENTAL QUALITY

a. Background

Israel is a small and crowded country, whose population is growing at a relatively rapid rate in international terms.

Israel is a small and crowded country, whose population is growing at a relatively rapid rate in international terms. Against this background, the preservation of land for future generations and the encouragement of high-density building become particularly important. There has been growing worldwide awareness in recent years of the need to preserve land for the benefit of future generations, to maintain open spaces, and the need to plan energy-efficient cities. National Master Plan 35, which was approved in 2005, was intended to provide for Israel's building and development needs, while preserving open spaces and land reserves for future generations. National Master Plan 38, which was approved in 2005 and is meant to strengthen existing structures against earthquakes, also encourages high-density building. Nonetheless, Israel, as well as other developed and developing countries, is experiencing rapid suburbanization, which is having undesirable effects on the environment and on economic efficiency. The main explanation for this phenomenon is the increase in the standard of living. The question is, should suburbanization be reduced, and if so, how?

b. The suburbanization trend

We define suburbanization as a transfer of population from a city to its less-crowded suburbs.

What is suburbanization? We will define it as a transfer of population from a city to its less-crowded suburbs. A suburb is defined in general as a rural settlement near a large city. In Israel, suburbanization involves the transfer of population from Tel Aviv to rural settlements located between Gadera and Hadera. The transfer of population from a large city to a less-crowded small city involves undesirable consequences similar to those of suburbanization.

Suburbanization has negative aspects from the perspective of economic efficiency and quality of the environment.

Suburbanization is a negative phenomenon from the perspective of economic efficiency and quality of the environment.³⁷ Thus, it consumes land for low-density residential use, which reduces the land reserves for future generations and for alternative uses, increases the use of transportation infrastructure, increases pollution,

³⁶ For further details, see the section on public transportation and communication in Chapter 2 of this report.

³⁷ OECD Environmental Outlook to 2030, OECD 2008.

the consumption of resources and the emissions of greenhouse gases and leads to under-utilization of infrastructure (due to the reduction in population density in the city as a result of the transfer of population to the suburbs).

The suburbanization process exists both in the EU-15 and in Israel. Thus, while the urban population in the Tel Aviv district grew by only 7.5 percent from 1995 to 2008, the population of the rural population in the Central district grew by 35 percent during that same period; at the same time, the urban population in the Central district, which is characterized by lower-density building than Tel Aviv, grew by 47 percent.

What factors are behind suburbanization? The move to the suburbs can be explained by the rise in the standard of living, one expression of which is the demand for lower-density housing, and perhaps also by the high price of housing in the Central district. The greater distance of the suburbs from places of work and commercial centers leads to increased demand for transportation both to and from and within the metropolis. This demand encourages greater supply, i.e., the construction of roads, which in turn encourages demand for housing in the suburbs. This in general leads to greater use of private vehicles since the population density in the suburbs is too low to create demand for public transportation services. As a result, there is a direct connection between the use of private vehicles and low-density building.³⁸

There is global awareness of the undesirable consequences of low-density building and there are some countries which propose policy solutions that involve both planning and economic measures. In various states in the US, a tax credit is being proposed for green construction,³⁹ which includes, among other things, elements of housing density, i.e., construction of at least 12 housing units in a building. In Israel, there are financial incentives for greater building density. National Master Plan 38 provides a financial incentive to reinforce building foundations and to add housing units to an existing building. The financial incentive is effective in areas with high housing prices while in urban areas with low housing prices the incentive barely makes an increase in density economically worthwhile.

c. International comparison of building density

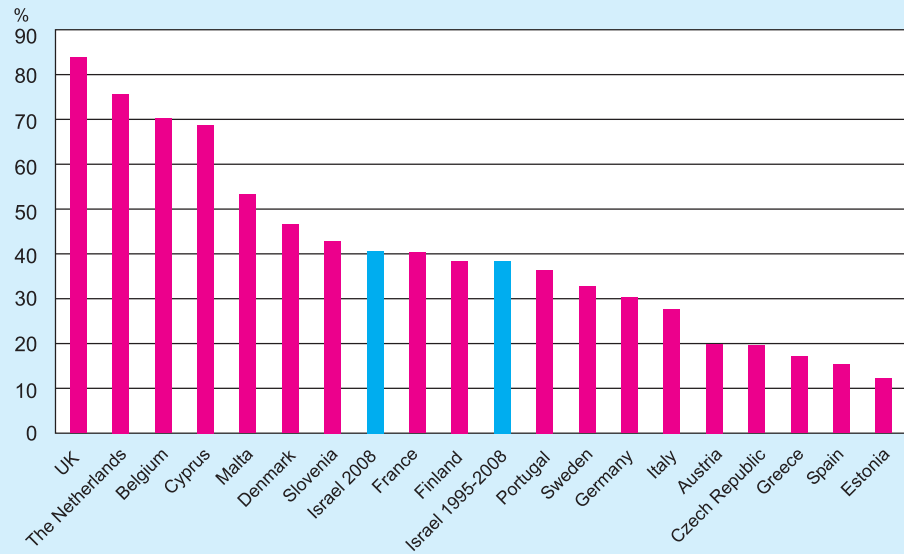
One possible index of suburbanization is the proportion of low-density buildings, i.e., the proportion of houses (as opposed to apartments in buildings of over two floors) within total housing in areas of high population density. In an international comparison, Israel's proportion of low-density buildings in areas of high population density (over 500 people per square kilometer) was found to be similar to the average for the EU (Figure 9.2 and 9.3). The proportion of low-density buildings is primarily

In an international comparison, Israel's proportion of low-density buildings in areas of high population density (over 500 people per square kilometer) was found to be similar to the EU average.

³⁸ Kenworthy et al., 2005; Newman et al., 1999.

³⁹ Examples include the green construction incentives in the State of New York, Maryland, and New Mexico. See <http://www.dec.ny.gov/energy/1540.html>.

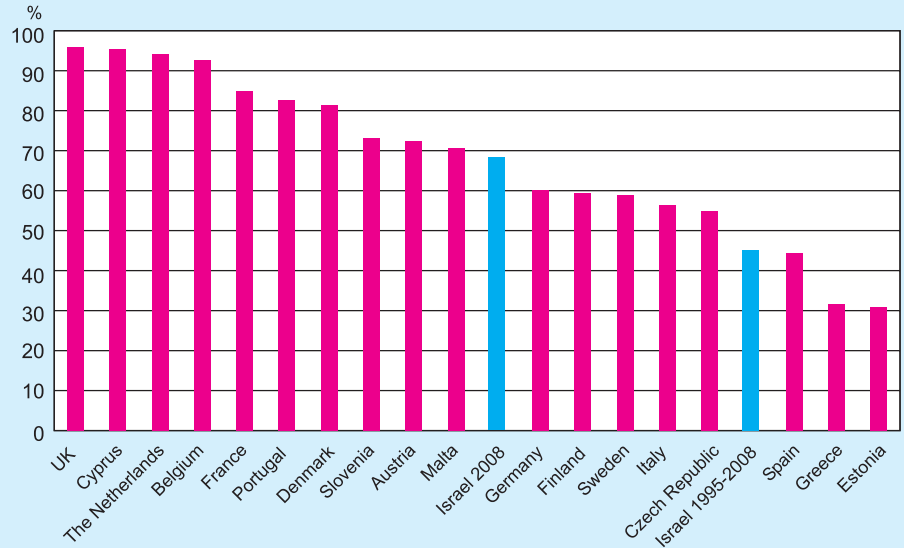
Figure 9.2
Share of Low-Density Houses in Areas with High Population Density^a



^a For all countries except Israel, the stock of low-density houses. For Israel, the stock of houses built in 1995-2008 (no data available prior to 1995), and the number built in 2008.

SOURCE: Eurostata and special calculations by the Central Bureau of Statistics.

Figure 9.3
Share of Low-Density Houses in Areas with Medium Population Density^a



^a For all countries except Israel, the stock of low-density houses. For Israel, the stock of houses built in 1995-2008 (no data available prior to 1995), and the number built in 2008.

SOURCE: Eurostata and special calculations by the Central Bureau of Statistics.

related to a country's lifestyle although the estimation showed that standard of living raises the proportion of low-density buildings only moderately.⁴⁰

d. The situation in Israel

The proportion of low-density buildings in areas of high population density has not declined in recent years while in areas of intermediate population density it has even increased (Figure 9.4). On the other hand, in the Tel Aviv and Central districts, the proportion of low-density buildings has declined somewhat in recent years.

It can be assumed that the proportion of low-density buildings in areas with high population density will decline somewhat in coming years, as a result of the transition to National Master Plan 35, which includes density targets, as opposed to its predecessor National Master Plan 31, which encouraged suburbanization. National Master Plan 38 also encourages greater building density, primarily in areas with high housing prices.⁴¹ However, there is also a long-term downward trend in density due to the increase in standard of living.

The question raised by the analysis of the rates of low-density building in the various regions and the expectations with respect to these rates in the future is whether and in which areas policy measures should be implemented in order to reduce the proportion of low-density buildings.

If the government decides that population densities in the Tel Aviv district, the Central district and other regions of high population density should be higher than those predicted by the trend that appeared in 2008, this should be accomplished by policy measures that do not restrain the development of the periphery.⁴²

In order to increase population density, whether beyond or within the targets in National Master Plan 35, several policy measures are being combined. These include: planning policy according to National Master Plan 35 and National Master Plan 38 and urban renewal programs—evacuation, building, and densification without evacuation which include economic incentives to increase population density; other economic incentives to increase population density; and transportation policy.

(1) Planning policy

Planning policy is the main tool for increasing levels of population density and is embodied in National Master Plan 35, a comprehensive master plan for construction, development and preservation approved by the government at the end of 2005. Its goal is to provide for the country's construction and development needs while preserving

⁴⁰ In a regression to explain a country's proportion of low-density buildings, it was found that population density and the size of the country were not significant. Per capita GDP was found to be significant in the range of \$16 thousand to \$57 thousand although its explanatory power (adjusted R²) was very low.

⁴¹ As a result of the construction in the Central district in recent years, primarily 2008 and 2009, there has been a very moderate increase and it can be assumed that part of the increase is due to the National Master Plan. In any case, only a few hundred housing units were added.

⁴² Development of the periphery is one of the declared aims of National Master Plan 35.

The proportion of low-density buildings in areas of high population density in Israel has not declined in recent years while in areas of intermediate population density it has even increased.

In order to increase population density, whether beyond or within the targets in National Master Plan 35, several policy measures are being combined.

Planning policy is the main tool for increasing levels of population density.

open spaces and land reserves for coming generations. It places emphasis on urban development and halting suburbanization; encouraging public transportation; the renewal and development of existing cities while investing in the elimination of social disparities; the preservation of environmental quality; and the development of the Negev and Galilee and the city of Jerusalem.

National Master Plan 35 contains targets for housing density, which are of course higher for urban areas than for rural ones. The density targets are based on an index of housing density, which is calculated according to the ratio between population and built-up area. This index, which is superior to the previous index (Figure 9.2 and 9.3) that classified housing units into only two categories (high- and low-density), expresses housing density in a continuous manner.⁴³ The required density targets in the urban environment of Tel Aviv are about 12-24 housing units on average per dunam and in the urban environments in the Central district the targets are even lower. These density targets are not particularly high in comparison to other countries and will result in a density of only 12,000 people per square kilometer in the core cities,⁴⁴ a level which has already been achieved in Tel Aviv but which is lower than in metropolises worldwide.⁴⁵

(2) Transportation and taxation policies that complement planning policy

National Master Plan 35 states that public transportation should be encouraged. A monetary incentive should be offered to reduce the use of private vehicles in urban areas, such as congestion charges in the Tel Aviv and Central districts. It is also desirable to develop mass transit systems in the Tel Aviv and Central districts which would make it possible to significantly increase housing density by encouraging commuting to the Tel Aviv business district. In the absence of a public transit system and a congestion charge on the roads, there is an incentive for population and businesses to move out of the Tel Aviv central business district.

If the decision is taken to increase population density targets beyond those in National Master Plan 35, it would also be worth considering a change in taxation policy that would support such a change. Thus, it is possible to strengthen the economic incentive provided by National Master Plan 38 in order to make it effective in areas of low housing prices as well. In addition, it is possible to provide municipalities with an incentive to increase housing density in evacuate-and-build programs. However,

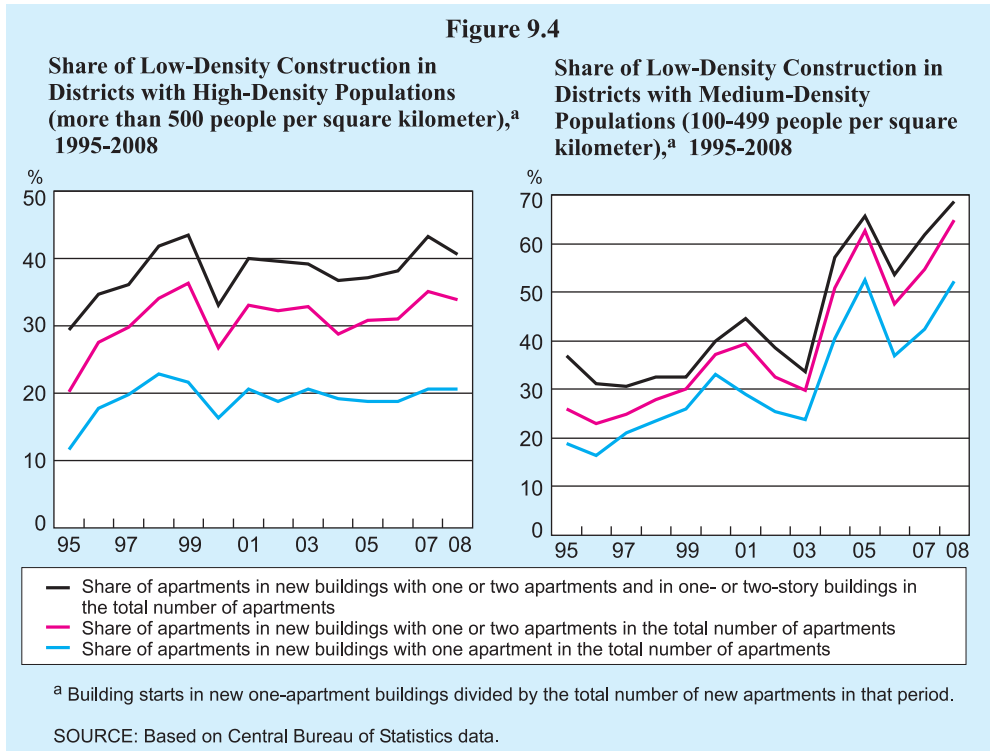
An amendment of taxation policy so that it would support planning policy should be considered.

⁴³ The disadvantage is that there are no reliable data on housing density, which is due to the fact that built-up areas were not properly marked in the 1990s. See Zoning Plan 35: Follow-up and Update, extension to Report Stage II, Land Characterizations, Planning Authority 2009.

⁴⁴ For the source, see Footnote 43.

⁴⁵ See, for example, Applied, "Outline of Economic Policy for Land Development in Urban Areas" (1999) which reaches the following conclusion, among others: "The urban centers in Israel are sparsely populated" (p. 5). For more details, see Chapter 3 there. Another document by Applied entitled "Increasing Competition in the Market for Residential Construction in Israel" (2007) concludes that the density in urban centers in Israel should be increased by 30-50 percent and in a manner that is consistent with accepted practices in metropolitan centers worldwide.

in order to encourage development in the periphery through lower housing density, it would be desirable to only partially implement these policies in the periphery.



Integration is needed between the various policy measures since they complement one another. For example, urban planning that defines density targets in the Central district; a transportation policy involving congestion charges and designated lanes for public transportation, and the development of mass transit in accordance with the density targets; and a taxation policy that supports these targets.

Integration is needed between the various policy measures since they complement one another.

