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Tax Reform in the Cypriot Road Transport Sector

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Abstract

The road transport sector contributes a significant fraction of government tax revenue in many countries, including Cyprus. Most revenue comes from excise taxes on vehicles and fuel and from road (circulation) tax. There is currently a need to modernize the tax system in order to provide a steady stream of revenue and to abide by environmental taxation principles increasingly being applied in Europe and elsewhere. We discuss the theoretical justification for transport sector taxation and the shortcomings of the current system and propose reforms aimed at achieving the twin goals of revenue stability and pollution reduction with minimal market distortion.

Keywords: vehicle taxation, carbon taxes, road tax, transport sector taxation.

1. Introduction

Taxation of road transportation is an important source of tax revenue in most countries. Cyprus is no exception: around 12% of overall tax revenue in recent years has come from this sector. Table 1 reports government revenue from transport-related taxes and fees for the period 2003-2012. The most important components of the transport tax system are excise taxes on fuel ('fuel tax') and vehicles ('vehicle tax'); the road (circulation) tax; and value-added tax (VAT). Until December 2012 a substantial registration fee was also assessed but this has now been reduced to a fixed fee of €150 per registration and is no longer an important source of revenue.

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TABLE 1

Tax revenue from the transport sector

Euro ('000s)	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Import duties	13.672	17.032	13.577	12.661	17.985	18.411	10.342	8.879	5.407	3.830
Registration fees	21.112	25.126	21.601	20.971	33.072	36.521	26.875	21.294	16.333	10.338
Vehicle tax	119.101	129.079	109.614	97.556	124.730	131.381	85.796	62.060	45.176	27.403
Vehicle VAT						90.780	54.440	53.589	43.512	
Total from vehicle sales (exc. VAT)	153.885	171.237	144.792	131.188	175.787	186.313	123.013	92.233	66.916	41.571
Road tax	71.109	76.994	79.212	80.229	83.291	88.921	91.320	89.970	91.509	91.893
Drivers' licenses	1.982	2.049	1.878	1.810	1.755	1.963	2.141	2.156	2.020	1.855
Road use permits	97	99	103	144	89	91	70	67	63	290
Fuel tax	226.205	254.747	251.618	255.979	269.622	261.483	263.384	308.060	337.207	317.157
Total (exc. VAT)	**453.278**	**505.126**	**477.603**	**469.350**	**530.544**	**538.771**	**479.928**	**492.486**	**497.715**	**452.766**

Sources: Ministry of Finance, Road Transport Department.

Total revenue from the transport sector peaked at €539 million in 2008 but has declined significantly since then owing to the large drop in new vehicle registrations. Total tax revenue (excluding VAT) in 2012 was almost 16% lower than in 2008. Taxes related to the sale of a new vehicle (i.e., the vehicle tax, the registration fee, and import duties) collapsed by 78%, while revenue from the fuel tax in the same period *increased* by 21%.

Cyprus is currently considering an overhaul of taxation related to road transport. The need for reform has arisen for two main reasons: (a) the decline of government tax revenue due to the crisis and to the substantial reduction of the registration fee; and (b) the need for taxation to abide by environmental principles aimed at reducing the emissions of pollutants from motor vehicles. The purpose of this paper is to evaluate the current system and to propose specific reforms that would improve the system's effectiveness in achieving the policy objectives of revenue generation and pollution reduction and at the same time reduce the distortionary effects of taxation.

2. Rationale and key features of road transport taxes

2.1 Aims and side effects

Taxation in the transport sector has two main objectives: (a) to correct the negative social impact (external cost) resulting from transportation; and (b) to provide the government with a steady and reliable stream of revenue. In designing a tax system to achieve these objectives, policy makers must bear in mind that all taxes have negative repercussions and create distortions. Some issues that need to be taken into account include the system's administrative costs; tax fairness and tax evasion; creation of market distortions and restriction of consumer choices; and the burden imposed on taxpayers.

2.2 The external cost of transport

Transportation imposes a social cost because it causes environmental pollution, congestion, wear of the road network and damages from accidents. The standard economic prescription to correct such externalities is to tax the activity generating the negative social impact; this is known as a Pigouvian tax. The tax leads to a reduction in the intensity of the said activity, and hence of its negative impact.

In the case of vehicles, the negative impact is caused when vehicles are driven on the road. Therefore, the tax should be targeted at usage and not at the purchase or ownership of vehicles. Several studies have investigated

the external costs associated with vehicles in an effort to quantify the different types of costs. In Table 2 we provide a summary of the relevant findings from Parry, Walls and Harrington's (2007) review of the literature. Two general and perhaps surprising conclusions are that:

a. The most important external cost is congestion rather than pollution.
b. Local pollution is more damaging than pollution attributed to carbon emissions.

TABLE 2

Summary of estimates of external cost from the use of vehicles in the USA

	Cent/gal.[a]	Cent/mile[a]
Central values for marginal external costs		
Fuel-related costs		
Greenhouse warning	6	0.3
Oil dependency	12	0.6
Sum	18	0.9
Mileage-related costs		
Local pollution	42	2.0
Congestion, cents/mile	105	5.0
Accidents	63	3.0
sum	210	10.0

Note: [a]Costs converted assuming on-road fuel economy of twenty-one miles per gallon.
Source: Parry, Walls and Harrington (2007).

It follows from the above that an effective tax should aim primarily at congestion and secondly at environmental pollution. Congestion cost is mainly the cost of time lost during journeys. This cost varies substantially depending on the time and location of travel. The consumption of a liter of fuel at peak hour in the center of a city imposes a much higher external cost than the consumption of a liter of fuel in a quite rural road. The best way to deal with the external cost of congestion is with congestion fees. Such fees have been adopted in several countries. Despite some concerns regarding loss of privacy, it is expected that their use will increase in the future as the required technology improves and becomes more affordable.

TABLE 3

Advantages and Disadvantages of different taxes

	Advantages	Disadvantages
Vehicle excise tax	– Easy to collect – Can depend on emissions – Some tax evasion related to used cars	– Variability revenue – Not related to usage – Reduced revenue from purchases of used vehicles – Large cost at time of purchase
Road (circulation) tax	– Can depend on emissions – Applies to both new and used vehicles	– Some administrative cost and tax evasion – Relation with usage is indirect and limited – Paid in lump sum
Fuel excise tax	– Easy to collect – Minimal tax evasion – Taxes usage – Applies to new and used vehicles	– Increases cost of commerce – Burdens commuters

2.3. Existing system

The pros and cons of the three main components of transport taxation currently applied in Cyprus are summarized in Table 3. In relation to the aforementioned objectives, the existing system has several weaknesses:

a. Vehicle sales are highly volatile as they are affected by macroeconomic factors and other changes in the economic environment. As a result, tax revenue associated with vehicle sales is also highly volatile, as can be observed in Table 1.
b. A large fraction of revenue comes from taxes on vehicle purchases and has no direct connection to the emission of pollutants.
c. The presence of many different taxes hinders transparency and creates unnecessary administrative cost.
d. The nature of taxes generates many distortions in the market. For instance, the vehicle tax is an increasing function of engine displacement but at each level the tax rate is imposed on the entire displacement rather than just on the incremental (marginal) units. This creates large discrepancies in taxation for relative small differences in engine displacement. As a result, some vehicles are favored while others are essentially driven out of the market.
e. High taxes on new vehicles lead to high imports of used vehicles. This has various adverse consequences such as significantly lower revenue for the government from VAT and excise tax, greater environmental pollution and congestion, possibly more accidents,

greater tax evasion, and a quality/technology gap due to the age of the vehicle fleet.

3. Reform options

It has been argued above that the ideal tax system must penalize activities incurring an external cost. The long-term policy objective should therefore be to: (a) abolish the vehicle excise tax and road tax; and (b) adopt a congestion fee and adjust the fuel consumption tax so that it reflects the true external cost and meets the government's revenue needs.

The long-term objective cannot be achieved at this juncture because imposition of a congestion fee is currently not possible in Cyprus. Given this, taxing fuel consumption is a reasonable alternative to the extent that consumption is related to congestion. However, immediate abolition of the vehicle tax and a corresponding increase in the fuel tax has at least two drawbacks. Firstly, the fuel tax has been raised recently (1/1/2013) by 7 cents per liter and is scheduled to increase by another 5 cents in 2014. Further increases would impose a heavy burden on consumers. Secondly, recent vehicle buyers have already paid vehicle tax and will be penalized as they will now have to pay a higher fuel tax as well. These negative consequences can be mitigated with a gradual transition from the vehicle tax to the fuel tax.

A second factor that restricts policy options is the government's need for increased revenue from this sector, as stipulated in the Memorandum of Understanding (MoU). Given current market conditions and the prolonged recession, it is highly unlikely that there will be increased revenue from taxes in the vehicle market (vehicle tax and VAT), a prediction that is also borne out in our simulations (see section 3.3). In fact, sales and associated tax revenue will likely continue to follow a downward trend for the next 2-3 years at least. Additional revenue may therefore only be collected from further increases in the fuel and road taxes. Since the fuel tax has already been increased and a new increase is planned, the road tax is perhaps the most appropriate policy instrument at present.

3.1 Road taxes

Road tax is currently calculated on the basis of engine displacement (see Table 4). In November 2012 a bill was introduced in Parliament with a provision to switch the base of the tax from engine displacement to CO_2 emissions. The proposal – whose discussion was postponed – called for a new fee structure that corresponded to a higher overall level of fee but would apply to new vehicle registrations only. This means that additional

revenue from the road tax would be limited. According to the proposal's estimates, based on 2011 sales, additional revenue would be €2 million in the first year and would rise by €2 million every year beyond that (that is, €4 million in the second year, €6 million in the third year, and so on). We updated this estimate using 2012 sales and found that additional revenue would be much lower, around €1,3 million, with a clear downward trend. A figure of €1 million is a reasonable upper bound on additional revenues to be raised from road taxes on *new* vehicle registrations. A second important disadvantage of raising road taxes for new vehicles only is that it increases the cost of purchasing a new vehicle as compared to keeping an existing one (which will pay a lower road tax), and therefore creates a disincentive for purchasing new vehicles.

TABLE 4

Existing road tax fees

Displacement (c.c.)	Fee (€/c.c.)	Indicative fee (€)
1-1450	0,04272	10-62
1451-1650	0,05980	87-99
1651-2050	0,11960	198-246
2051-2250	0,14523	297-326
2251-2650	0,19649	443-521
2651-	0,19649	521-

Note: Existing fees are further differentiated on the basis of emissions. Using M to denote emissions, there is a 30% discount for M≤120, a 20% discount for 120<M≤165, a 10% discount for 165<M≤200, a surcharge of 10% for 200<M≤250, and a surcharge of 20% for M>250.

For these reasons, the switch of the base of the road tax from displacement to emissions must be accompanied with an increase in road tax rates for existing vehicles also. Ideally, one would want to have a uniform tax system for all vehicles. This cannot be done on the basis of emissions because the relevant information is not available for older vehicles (those registered before 2007). An alternative would be to tax vehicles registered since 2007 on the basis of emissions and vehicles registered earlier on the basis of engine displacement. This is also not possible for legal reasons; taxation based on pollutants can be applied only to new registrations. The only remaining option is to tax new registrations on the basis of emissions and existing vehicles using the existing system but at different rates. We discuss possible fee structures below.

TABLE 5

Proposed road tax fees

CO_2 (gr/km)	Road tax (€) November proposal	Road tax (€) Alternative proposal
0-100	0	50
101-110	20	60
111-120	40	70
121-130	70	80
131-140	100	90
141-150	130	100
151-165	150	120
166-175	200	150
176-185	300	250
186-200	400	350
201-225	600	450
226-256	850	600
257+	1300	800

3.1.1 Road tax for the existing fleet

Existing fees are very low for small- and medium-sized vehicles (up to 1650cc) and very high for larger vehicles. Since most registrations are of vehicles up to 1650cc (see Table 6), the objective of higher revenue can only be achieved if rates are increased in this category. We have examined two alternative ways of raising fees for existing vehicles:

1. Flat surcharge on all vehicles
2. Increase (and rounding) of rates

1. Flat surcharge

It is estimated that in 2013 around 600 thousand vehicles will pay road taxes (580,246 had already paid by 23rd April 2013). Based on this, a flat increase of €10 in the road tax of all vehicle categories will yield €6 million of additional revenue. It is wise to adopt a more conservative prediction of €5 million for a €10 increase per vehicle because it is expected that payments will drop in the upcoming years due to the economic crisis. Consequently, a €20 increase in the road tax per vehicle will yield approximately €10 million in additional annual revenue.

2. Rate increases

Table 4 shows a proposal for increasing road tax rates (and retaining the emissions-based discount/surcharge). The proposed rates were chosen so that the fees will increase by approximately €20 for most vehicles, with the exception of larger vehicles for which the increase will be slightly higher. The increase per category is shown in the last column of the Table. Figure 1 displays the change in the tax at the more disaggregated level of the deciliter (one tenth of a liter, known in Cyprus as an 'άλογο' (horse)). It can be noted that the increase for vehicles in the 1650-2050cc category is slightly lower than the increase for smaller vehicles. This is because taxes on this category are already quite high.

This proposal is expected to generate €4.8 million from vehicles registered in the period 2007-2012. These are about 200 thousand vehicles, i.e., one third of the fleet. A conservative prediction is that about €12 million in additional annual revenue can be generated from the entire fleet by imposing the suggested fee structure.

3.1.2 Fees for new registrations

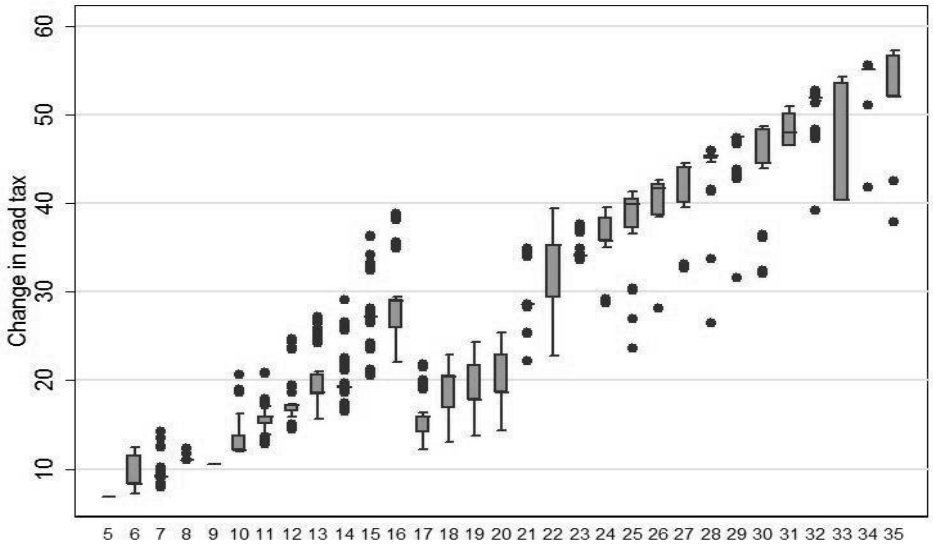
In Table 6 we present two proposals; the proposal regarding the fees for new registrations included in last November´s bill, and an alternative one that we believe will be more effective in meeting policy objectives in the current market conditions. The main elements that differentiate the new proposal are:

- A fee is levied on all vehicles, even those with emissions below 100. This increases revenue by broadening the tax base.
- Categories in the range 150-200 are narrower so as to avoid large fee discrepancies when moving from one category to the next.
- The fees for high-emission vehicles are lower so that they do not become prohibitive.

As mentioned before, the new fees are not expected to yield significant revenue to the government in the upcoming years due to the large drop in new registrations.

FIGURE 1

Increase in road tax by vehicle size (unit is a deciliter)



3.2 Fuel consumption tax

As we argued above, the fuel consumption tax has many advantages. Despite recent increases, the tax rate in Cyprus is still one of the lowest in the European Union. In the last months there was a noticeable reduction in the consumption of road fuel (95 and 98 octane gasoline and diesel). In the two month period between January and February 2013, 82.9 thousand tons of road fuel was sold compared to 92.8 tons during the same period in 2012, a 10.7% decrease. If this decrease is representative of the whole year, consumption in 2013 will be about 540 thousand tons (compared to 604 thousand in 2012). Given that the economic conditions will deteriorate, a prediction is that consumption will be close to 500 thousand sees more realistic (and might even turn out to be optimistic). This means that every cent in increase (per liter) of the fuel tax will generate about €5 million in additional revenue.

TABLE 6

Vehicle registrations in 2012 by emissions and engine displacement

CO_2 (gr/km) / Displacement	1-1450	1451-1650	1651-2050	2051-2250	2251+	Total
0-100	156		115			271
101-110	193					193
111-120	885	174				1.027
121-130	1.026	303				1.329
131-140	788	342	105			1.235
141-150	2.333	1.594	505	35		4.467
151-165	1.694	3.270	1.052			6.016
166-175	454	378	915	762		2.509
176-185	42	534	326	231		1.133
186-200		141	336		51	528
201-225		167	158	95	45	465
226-256					108	108
257+	24				104	128
Total	7.598	6.903	3.511	1124	308	19.409

3.3 Vehicle tax

We have argued above that the long-term objective should be the abolition of the vehicle tax. Although this is not a realistic option at this point, a reduction in vehicle taxes might be appropriate even if it leads to some loss of revenue. The rationale for a reduction in the vehicle tax is the following:

a. Given the current extremely low level of new registrations, the loss of revenue will be small.
b. If the reduction leads to increased sales, then part of the revenue loss will be offset by higher revenue from VAT and other taxes.
c. If the reduction leads to a shift of sales from used to new vehicles, it will generate bigger revenue from VAT (as most used vehicles do not pay VAT).
d. It gives a boost to the vehicle market that has been heavily hit by the recession.
e. In a period of increasing taxes, any positive news in the form of a tax reduction may be useful. atmay.

If sales were to remain the same, a 10% reduction in vehicle tax rates would decrease revenue by 10%. However, it is highly likely that sales will change for the reasons identified in points (b) and (c) above. Therefore, in order to properly design the tax system, we need to estimate how the market will react to different tax reform scenarios.

For this purpose we have estimated a vehicle demand system based on historical data from the Cyprus market for the period 2006-2012. We then used the estimated demand system to simulate various taxation scenarios. This is a useful exercise because it allows us to examine how different taxes impact different market segments and to calculate resulting revenues. This approach has recently been used for ex-post assessments of CO_2-based tax schemes implemented in specific countries, such as Bastard (2010) for France and Rogan, Dennehy, Daly, Howley, and Ó Gallachóir (2011) for Ireland. The ex-ante analysis we use here has been used by Adamou, Clerides and Zachariadis (2012, 2013) for Greece and Germany respectively and by Christodoulou and Clerides (2012) for Cyprus. The exercise does have some limitations that are worth pointing out:

a. The model we use is designed to estimate substitution elasticities between different models and is known to perform well in this regard. It does not perform as well in estimating overall market fluctuations, especially in periods of high uncertainty like the current situation in Cyprus. In other words, the system estimates well the shifts within the market quite, but less so the overall direction of the market.
b. The simulations allow consumer demand to shift over time but elasticities remain constant.
c. It was not possible to estimate with sufficient accuracy the degree to which consumers take into account the annual road tax. For this reason, in the simulations we experimented with different scenarios for this parameter. Our calculations show that the extent to which consumers take the road tax into account does not make much difference qualitatively. The estimates we report assume that the road tax is not taken into account at the time of purchase.
d. In cases of large price changes, the estimates have a large margin of error.

Data for the period 2006-2012 were obtained from three sources. The Cyprus Road Transport Department (RTD) provided data on automobile registrations, including several attributes of registered vehicles (engine capacity, CO_2 emissions, fuel type, etc.). Information on vehicle prices was obtained from motor vehicle importers, who provided us with actual transaction prices, something quite rare in this literature. Where importer prices were not available we used list prices from the monthly magazine

4Τροχοί (4Wheels) and applied to them a discount similar to what is applied for other models. Vehicle characteristics were also obtained from 4Τροχοί. Prices and sales were matched into a single dataset where an observation is defined by the model name, import condition (new or used) and engine capacity. That is, vehicles which differ in one of the above attributes are recorded as two different observations.

Demand for automobiles was estimated using a two-level nested logit model of demand for differentiated products. The methodology is well developed and is the standard method of estimating demand for automobiles. Extensive experimentation with different nesting structures led us to the choice of import condition and market segment as the most appropriate classifications for our data. Estimation using market segment as the group and import condition as the subgroup produced the appropriate relationship that is required for consistency with random-utility maximization. Market segment was determined by dividing vehicle models into five groups on the basis of engine capacity, as in Christodoulou and Clerides (2012); see this paper (which performs a similar analysis for Cyprus using data from an earlier period) for more details on the method and data.

With the estimated demand system in hand, one can proceed with policy simulations. This requires an assumption on how prices will respond to the introduction of the scheme. There are two possibilities. The first is to assume that firms are engaged in a differentiated product pricing game. The alternative approach is to assume that taxes will be completely passed through to final prices. There is a tradeoff between these approaches. The primary advantage of the first approach is its firm theoretical grounding, whereas the primary advantage of the second is that it is much easier to implement. We opted for the second approach since empirical evidence indicates that tax pass-through is often close to 100%.[1] We believe that in the short-run - which is the scope of our analysis - this may be a reasonable approximation of reality, perhaps more so than the assumption of Bertrand-Nash pricing. We also take comfort from the work of Adamou, Clerides and Zachariadis (2012) that uses both approaches in the case of Greece and finds little difference in the final outcome.

Once simulated prices have been determined, it is straightforward to compute the sales of every model in each hypothetical scenario and the impact of any policy scheme on government revenues. In the rest of this section we present and discuss the estimates of government revenues in the different scenarios. Parameter estimates from the two-level nested logit

[1] See Besley and Rosen (1999) for an example.

model and simulated prices and market shares are provided in the Appendix.

TABLE **7**

Scenarios about consumption tax

Co2 (Gr/Km)	Consumption Tax (€/gr.) Scenario 1	Consumption Tax (€/gr.) Scenario 2
0-100	0	4
101-110	2	6
111-120	3	8
121-130	4	10
131-140	5	13
141-150	7	16
151-165	9	20
166-175	13	24
176-185	20	28
186-200	30	32
201-225	40	37
226-256	65	42
257+	100	50

We have analyzed various scenarios; here we present the results from three of them. The first two scenarios are shown in Table 7. The third scenario examines the case of abolishing the vehicle tax.[2] The resulting revenue in each scenario for the year 2012 is presented in Table 8. The first row ('Current') gives actual revenue (according to our own calculations) from each tax in 2012. The next rows give the revenues we would have had in 2012 if each scenario had been adopted. For each of the three scenarios, we present two variations. In the row labeled 'Actual' we record the tax revenue that would have been raised by the vehicle tax under consideration using the actual (realized) sales. In the 'Simulated' row we do the same calculation using the sales predicted by our model. The difference between the two rows is due to the shift in sales induced by the

[2] We gratefully acknowledge the contribution of the Road Transport Department in determining the choice of scenarios.

tax. The prices and sales that result in the different scenarios are provided in the Appendix.

TABLE 8

Tax revenues in the simulations

Policy	VAT	Consumption Tax	Registration Fee	Road Tax	Total
Current	39.642	26.762	7.328	1.832	75.564
Scenario 1					
Actual	41.166	21.838	2.963	3.302	69.269
Simulated	40.964	21.302	2.940	3.218	68.423
Scenario 2					
Actual	41.822	38.446	2.878	3.278	86.424
Simulated	41.616	37.870	2.855	3.186	85.526
Scenario 3					
Actual	40.517	0	3.076	3.640	47.233
Simulated	40.349	0	3.050	3.531	46.929

Under Scenario 1 the difference between the two rows (with actual and simulated sales) is small because the change in the vehicle tax is small. There is a revenue decrease of about €5.2 million, a 20% drop. Revenue from VAT increases by about €1.8 million and partly offsets this decrease. Overall, there is a net loss of about €3.4 million. Apart from the bigger magnitudes due to the larger decrease in vehicle tax, the other two scenarios yield similar results. The most important conclusion is that the percentage of reduced revenue (due to a decrease in vehicle tax) that is offset by increased VAT revenue ranges from about 37% in scenario 1 to 15% in scenario 3.

Note that according to current trends, new registrations of vehicles will record a 30-40% drop in 2013 relative to 2012. If we assume that the revenue from the current vehicle tax amounts to €15 million, then adopting scenario 1 would result in a loss in revenue of about €1.9 million.

3.4 Summary of options

In this section we considered the prospect of raising government revenue from the various tax instruments available. Our conclusion is that an

increase in the road tax is the most promising option, perhaps accompanied by a small increase in the fuel tax (in addition to that already stipulated in the MoU). The vehicle tax cannot be expected to be a significant source of revenue in the next few years, which makes this a good juncture to reduce the tax. Policy options for raising additional revenue from the road transport sector are summarized in Table 9.

TABLE 9

Predicted Government Revenues under Specific Policy Changes

Policies	Expected revenues
Increase in road tax - flat surcharge on all vehicles	€5 million for a €10 increase per vehicle
Increase in road tax - increase of rates as in Table 4	€12 million
Increase in fuel consumption tax	€5 million for every cent in increase

4. Conclusions

Taxation in the Cypriot road transport sector needs to be reformed in order to be consistent with the goals of revenue generation and pollution reduction. Most of the weaknesses of the existing system can be traced to the vehicle excise tax. In the medium run, this tax needs to be abolished. Lost revenue can be replaced by adjusting the fuel excise tax and the road tax. There are several advantages to such a shift:

a. It produces a stable and predictable stream of revenue.
b. Taxation targets the use of fuel - the source of pollution – and thus leads to a reduction in emissions. It is compatible with the economic reasoning of the Pigouvian tax.
c. It treats new and used vehicles equally.
d. It is simple, transparent and difficult to evade.
e. By lowering vehicle prices, it makes it easier for drivers to purchase new vehicles with the latest technology and modern safety standards.
f. It will provide a boost to the automobile market at this difficult juncture.

Abolishing the vehicle tax completely at this time is not feasible because of the associated revenue loss. On the other hand, the current juncture

presents an opportunity to proceed with a modest decrease in the tax as the revenue loss will be quite small and the market response will be instructive.

In the longer run, the policy objective should be the introduction of congestion fees, perhaps as a replacement of the road tax. Congestion is the single largest external cost of transportation and the tax system should be designed to correct this externality. The use of congestion fees has been increasing in recent years and Cypriot policy makers should start thinking about how they could be implemented in Cyprus in the near future.

Appendix

Demand estimates

Table 10 reports estimates of the nested logit demand system. The 2-level NML estimates are from a two-level nested logit with size classes as the first group and import condition (new or used) as the second group. Estimation closely follows Adamou, Clerides and Zachariadis (2013); we refer interested readers to that paper for the details.

TABLE 10

Demand Estimates

Variables	*2-level Nested logit estimates*
Price	-0.029***
	-0.0020
ln(sj/h)	0.720***
	0.017
ln(sh/g)	0.442***
	0.047
Diesel	0.068
	0.063
Other Fuel	-0.0052
	0.185
Maximun Speed	0.0036*
	0.0019
Acceleration	-0.054**
	0.021
CO2 Emissions	-0.00042
	0.00087
Age	-0.107***
	0.013
Constant	-4.437***
	0.587
F-test	115.96***
H_0: $\sigma_1 = \sigma_2$	32.49***

Notes: Significance levels: ***: 1%, **: 5%, *: 10%. Standard Errors are in parentheses.

A. SENARIO 1

Prices of New Cars

Emissions	Up to 1450	1451-1650	1651-2250	2251-2650	2651-3000	3001+
Up to 120	14,200 13,882	17,925 17,602				
121-165	15,042 15,307	19,250 19,978	43,351 38,301			
166-200	34,456 37,974	16,900 18,708	33,250 31,066		110,222 95,604	
201-250					104,054 95,502	
251+						

Prices of Used Cars

Emissions	Up to 1450	1451-1650	1651-2250	2251-2650	2651-3000	3001+
Up to 120	10,630 10,614		16,371 13,318			
121-165	5,488 5,776	7,759 7,912	23.358 20.276			
166-200	7,367 8,360	7,701 8,628	20,760 18,154			
201-250		8,619 13,382	9,800 9,476		53,024 44,972	
251+	4,609 13,050				36,581 36,921	37,029 32,519

	Sales of New Cars						
Emissions	Up to 1450	1451-1650	1651-2250	2251-2650	2651-3000	3001+	Total
Up to	1029	174					1202
120	1071	185					1256
	1093	190					1282
121-	3429	3815	1052				8296
165	3364	3791	1320				8474
	3323	3775	1334				8433
166-	12	222	325		51		611
200	9	189	306		98		601
	8	182	289		102		582
201-					13		13
250					14		14
					12		12
251+							
Total	4470	4211	1377		65		10123
	4443	4165	1625		111		10345
	4424	4147	1624		115		10309

Sales of Used Cars

Emissions	Up to 1450	1451-1650	1651-2250	2251-2650	2651-3000	3001+	Total
Up to 120	206		115				321
	212		129				342
	217		139				356
121-165	2413	1694	646				4753
	2395	1752	704				4850
	2370	1760	713				4842
166-200	484	831	2245				3560
	458	766	2392				3617
	438	725	2387				3551
201-250		167	252		139		558
		107	215		183		505
		90	188		186		464
251+	24				67	37	128
	10				46	39	95
	6				38	33	77
Total	3128	2692	3258		206	37	9320
	3076	2625	3441		229	39	9409
	3032	2575	3428		223	33	9291

B. SCENARIO 2

Prices of New Cars

Emissions	Up to 1450	1451-1650	1651-2250	2251-2650	2651-3000	3001+
Up to 120	14,200 14,303	17,925 18,269				
121-165	15,042 16,787	19,250 21,553	43,351 39,939			
166-200	34,456 39,640	16,900 20,729	33,250 32,123		110,222 96,046	
201-250					104,054 89,312	
251+						

Prices of Used Cars

	Up to 1450	1451-1650	1651-2250	2251-2650	2651-3000	3001+
Up to 120	10,630 11,007		16,371 13,557			
121-165	5,488 6,335	7,759 8,623	23,358 21,055			
166-200	7,367 9,032	7,701 9,401	20,760 19,013			
201-250		8,619 12,979	9,800 9,269		53,024 43,526	
251+	4,609 8,944				36,581 30,980	37,029 27,769

	Sales of New Cars						
Emissions	Up to 1450	1451-1650	1651-2250	2251-2650	2651-3000	3001+	Total
Up to	1029	174					1202
120	1092	194					1286
	1114	199					1312
121-	3429	3815	1052				8296
165	3185	3578	1228				7991
	3147	3563	1243				7953
166-	12	222	325		51		611
200	8	170	304		86		567
	7	164	287		91		549
201-					13		13
250					24		24
					22		22
251+							
Total	4470	4211	1377		65		10123
	4285	3941	1532		109		9867
	4268	3925	1530		112		9836

Sales of Used Cars							
Emissions	Up to 1450	1451-1650	1651-2250	2251-2650	2651-3000	3001+	Total
Up to	206		115				321
120	215		136				351
	220		146				366
121-	2413	1694	646				4753
165	2348	1744	691				4783
	2325	1752	701				4778
166-	484	831	2245				3560
200	447	756	2315				3518
	428	716	2311				3454
201-		167	252		139		558
250		119	237		180		536
		100	208		184		491
251+	24				67	37	128
	17				64	52	133
	10				53	45	109
Total	3128	2692	3258		206	37	9320
	3027	2619	3379		244	52	9320
	2983	2568	3365		237	45	9198

C. SCENARIO 3

Prices of New Cars

Emissions	Up to 1450	1451-1650	1651-2250	2251-2650	2651-3000	3001+
Up to 120	14,200 13,882	17,925 17,202				
121-165	15,042 14,506	19,250 18,314	43,351 36,921			
166-200	34,456 33,809	16,900 15,843	33,250 25,573		110,222 88,970	
201-250					104,054 78,010	
251+						

Prices of Used Cars

Emissions	Up to 1450	1451-1650	1651-2250	2251-2650	2651-3000	3001+
Up to 120	10,630 10,378		16,371 13,318			
121-165	5,488 5,319	7,759 7,347	23,358 19,670			
166-200	7,367 7,236	7,701 7,177	20,760 16,230			
201-250		8,619 8,012	9,800 6,724		53,024 38,370	
251+	4,609 4,837				36,581 25,040	37,029 23,019

	Sales of New Cars						
Emissions	Up to 1450	1451-1650	1651-2250	2251-2650	2651-3000	3001+	Total
Up to	1029	174					1202
120	1040	175					1215
	1062	179					1241
121-	3429	3815	1052				8296
165	3499	3926	1304				8729
	3458	3912	1323				8693
166-	12	222	325		51		611
200	12	232	453		102		799
	11	223	429		108		772
201-					13		13
250					44		44
					40		40
251+							
Total	4470	4211	1377		65		10123
	4552	4332	1757		145		10787
	4531	4314	1752		149		10746

Sales of Used Cars							
Emissions	Up to 1450	1451-1650	1651-2250	2251-2650	2651-3000	3001+	Total
Up to	206		115				321
120	206		115				322
	212		124				336
121-	2413	1694	646				4753
165	2419	1692	675				4786
	2397	1705	685				4786
166-	484	831	2245				3560
200	482	836	2497				3815
	461	793	2495				3750
201-		167	252		139		558
250		171	270		201		642
		144	238		206		588
251+	24				67	37	128
	23				75	57	155
	14				63	49	126
Total	3128	2692	3258		206	37	9320
	3130	2699	3558		277	57	9720
	3084	2642	3543		269	49	9586

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