# “Modeling the environmental taxation: the case of Ukraine”



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# Modeling the environmental taxation: the case of Ukraine

Abstract

In this paper a model of macroeconomic equilibrium, that quantitatively describes the causal relationships between the components of the economic system of Ukraine, is proposed. This model allows to determine the optimal environmental tax rate for the given parameters of socio-economic development in Ukraine.

**Keywords:** environmental tax, optimal environmental tax rate, economic damage from pollution, model of macroeconomic equilibrium.
**JEL Classification:** Q50, Q59.

## Introduction

Environmental taxation is an important instrument of state environmental management. However, changes in environmental taxation can lead not only to changes in the environment, but also to changes in the economic behavior of taxpayers. Therefore, developing and adopting appropriate management decisions about changes in rates of environmental taxes require the information about possible consequences of such actions. This allows to choose among alternatives the one that meets objectives of public policy the best. Such information can be provided by modeling the main causal relationships in the economy related to environmental taxes and their rates.

The main problem in management of natural resources by using taxes is development of such environmental taxation mechanism, which on the one hand will encourage the implementation of ecological safety technologies and productions and provide compensation of the negative effects of environmental pollution, and on the other hand – will not restrain the economic development. Such balance is a key issue in the construction of optimal environmental taxation mechanism.

Despite the variety of existing models, their practical implementation in Ukraine is difficult. Complicacy is caused by the theoretical orientation of the most of the models and by the fact that they do not incorporate the Ukrainian specificity.

So the aim of this research is development of environmental tax rate model that will incorporate the specificity of Ukrainian economic system. This model has to consider the main causal relationships in Ukraine, which are related to environmental taxes and their rates.

The remainder of this paper is organized as follows. Section 1 reviews the existing literature on environmental taxation and its modeling. Section 2 provides the methodology. Next follows a section that presents the results and key findings of the study. The final section concludes the paper.

## 1. Literature review

Environmental taxation and determination of optimal tax rate act as objects of research in many publications. Pigou (1920) was the first who described the mechanism of ecological taxation. He proved that it becomes optimal only when tax rate equals marginal economic costs. In this case increasing of negative externalities from enterprise to ecology should proportionally multiply the sum of ecological tax paid to the state.

Baumol (1972) discovered environmental taxation with the purpose to estimate such rates of environmental taxes which could provide maximum utility. The main limitation of his model is neglection of presence of other taxes which create distortions in economics. Also the model is greatly simplified by considering the only one resource, labor.

Sandmo (1975) was the first who modified the model of environmental taxation considering the presence of preexisting distortionary taxes. His model demonstrated that optimal rate of environmental tax is influenced by fiscal taxes. But Sandmo (1975) noted that his study is more theoretical and is not adapted for practical application. Most of further studies (Lee and Misiolek, 1986; Oates, 1993; Bovenberg and de Mooij, 1994; Bovenberg and Goulder, 1996; Fullerton and Kim, 2006) count distortionary taxes to determine the optimal environmental taxation.

The main limitation of most of the existing models of environmental taxation is that they have more theoretical than practical focus. Lee and Misiolek (1986), Oates (1993), Bovenberg and de Mooij (1994), Bovenberg and Goulder (1996) in their studies investigated if optimal environmental tax rate in presence of preexisting distortionary taxes is higher, lower or equal to Pigovian rate that represent social marginal damages of pollution. The theoretical character of their studies doesn't allow to estimate the exact size of optimal environmental tax rate.

Another problem is that models in these studies and a lot of other studies (Jaeger, 2002; Parry, Williams and Goulder, 1999; West and Williams, 2004; Fullerton and Metcalf, 2001) are based on utility function that can be hardly estimated on practice. Also expressions of utility function can differ greatly depending on the groups of stakeholders. Also it is not clear how the preferences of stakeholders should be identified.

In all described models the base of environmental taxes is the dirty commodity which produces pollution. It can be explained by the fact that in the 1920s when Pigou developed his study on environmental taxation the only way to reduce emissions was to reduce production of dirty commodities because there were no abatement technologies available. Pigou's approach of taxing quantities of production was followed by other scientists. That is the reason why abatement activities are ignored in most of models.

But nowadays enterprises have a possibility to reduce emissions by implementing abatement technologies. Considering that alternative way of ecological regulation the new approach of optimal environmental taxation should be developed.

An attempt to incorporate investments in abatement activities into model of optimal environmental tax was undertaken by Fullerton and Kim (2006). But their model is limited by the assumption that investments can spent only for one of two alternatives: for abatement technologies or for increasing production, but not for both of them. Also Fullerton and Kim (2008) noted that their model is unusable for getting practical results.

So, the analysis of existing models of optimal environmental taxation shows that they have more theoretical than practical value. Using of them can't provide specific recommendations for setting the environmental tax rate. Also these models don't consider the specified parameters of the Ukrainian economic system.

## 2. Data and methodology

We propose to develop a model that allows to discover the main cause relations in Ukraine, which are related to environmental taxes and their rates.

As an object of modeling environmental tax for emissions into the air was chosen. This choice is explained by the prevailing role of this type of environmental tax among the others. In 2012 almost 70% of environmental tax were paid exactly for this type of pollution (http://www.ukrstat.gov.ua).

The aim of developing the model is identification of optimal tax rate according to the goals of state economic policy.

As a basic equation for this model we chose the Cobb-Douglas function that explains the relationship between industrial production and main production resources – capital and labor.

In case of ecological taxation in Ukraine the Cobb-Douglas function should be modified. The labor factor needs to be excluded. It is explained by the fact that there is no strong connection between the number of employed in industry and pollution activity in the industry in Ukraine nowadays.

To prove this we calculated correlations between these factors during 1992-2012 case of air pollutions and air-depended illnesses. The cancer incidences and diseases of the respiratory system (the most important types of illnesses connected with the air pollution) were chosen as health indicators.

Correlation coefficient for the diseases of the respiratory system and the amount of air emissions is 0.47. It means that connection between these two factors in insignificant and there is no strong statistical connection between diseases of the respiratory system and the amount of air emissions.

The number of cancer incidences is also not connected with the amount of air emissions. Correlation coefficient is -0.44.

To incorporate the time lags effects we re-calculated correlation coefficients for different lags (-1, -2, -3 etc.). Doing this we were trying to check if the connection exists but it is lagged. Nevertheless, calculations show no statistically significant direct relationship between analyzed factors (Table 1). The only conclusion in this case is there is no connection between the amount of air emissions and labor. So we can ignore the labor part of Cobb-Douglas function.

Table 1. Correlation coefficients for the amount of air emissions and air-depended illnesses, calculated for different time lags

| Air emissions | Diseases of the respiratory system | Time lag. number of years | Correlation coefficient | Air emissions | Cancer incidences | Time lag. number of years | Correlation coefficient |
|---|---|---|---|---|---|---|---|
| 1992-2012 | 1992-2012 | 0 | 0.47 | 1992-2012 | 1992-2012 | 0 | -0.44 |
| 1992-2011 | 1993-2012 | 1 | 0.30 | 1992-2011 | 1993-2012 | 1 | -0.54 |
| 1992-2010 | 1994-2012 | 2 | -0.10 | 1992-2010 | 1994-2012 | 2 | -0.63 |
| 1992-2009 | 1995-2012 | 3 | -0.06 | 1992-2009 | 1995-2012 | 3 | -0.67 |

Table 1 (cont.). Correlation coefficients for the amount of air emissions and air-depended illnesses, calculated for different time lags

| Air emissions | Diseases of the respiratory system | Time lag. number of years | Correlation coefficient | Air emissions | Cancer incidences | Time lag. number of years | Correlation coefficient |
|---|---|---|---|---|---|---|---|
| 1992-2008 | 1996-2012 | 4 | -0.54 | 1992-2008 | 1996-2012 | 4 | -0.68 |
| 1992-2007 | 1997-2012 | 5 | -0.36 | 1992-2007 | 1997-2012 | 5 | -0.68 |
| 1992-2006 | 1998-2012 | 6 | -0.35 | 1992-2006 | 1998-2012 | 6 | -0.68 |
| 1992-2005 | 1999-2012 | 7 | -0.18 | 1992-2005 | 1999-2012 | 7 | -0.73 |
| 1992-2004 | 2000-2012 | 8 | -0.23 | 1992-2004 | 2000-2012 | 8 | -0.78 |
| 1992-2003 | 2001-2012 | 9 | -0.48 | 1992-2003 | 2001-2012 | 9 | -0.79 |
| 1992-2002 | 2002-2012 | 10 | -0.67 | 1992-2002 | 2002-2012 | 10 | -0.86 |
| 1992-2001 | 2003-2012 | 11 | -0.59 | 1992-2001 | 2003-2012 | 11 | -0.79 |

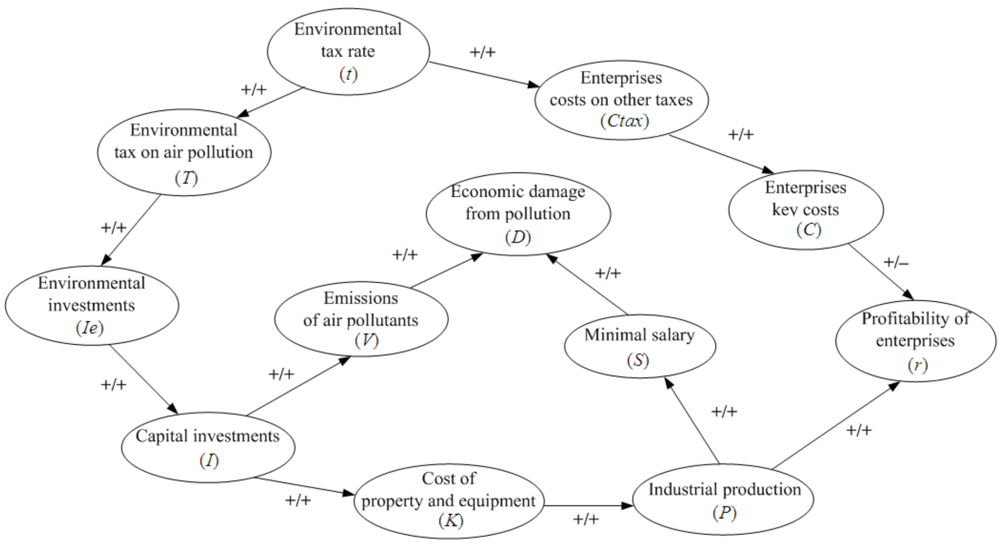
Certain limitations for this model are explained by the existing statistical database and indicators which are used to explain social-economic situation in Ukraine.

According to these we formed the following list of factors that act as variables in the proposed model (Table 2).

Table 2. Variables of the model

| Variable | Symbol | Units |
|---|---|---|
| Environmental tax rate | *t* | UAH/ton |
| Environmental tax on air pollution | *T* | mln. UAH |
| Emissions of air pollutants | *V* | thous. ton |
| Economic damage from pollution | *D* | mln. UAH |
| Capital investments | *I* | mln. UAH |
| Environmental investments | *Ie* | mln. UAH |
| Enterprises key costs (salary, taxes, etc) | *C* | mln. UAH |
| Enterprises costs on other taxes | *Ctax* | mln. UAH |
| Profitability of enterprises | *r* | % |
| Minimal salary | *S* | UAH |
| Cost of property and equipment | *K* | mln. UAH |
| Industrial production | *P* | mln. UAH |

Visual interpretation of connections between these variables are presented in Figure 1.




Notes: **+/+** means direct connection, **+/–** means indirect connection.

**Fig. 1. Visual interpretation of connections between model variables**

To find, calculate and prove the existence of statistically significant connections between variables regressions analysis was used. As a result we obtained mono- or multifactorial regression equations.

To assess the adequacy of the obtained models generally accepted criterions were used:

- Coefficient of determination.
- Adjusted coefficient of determination.
- *F*-test and the probability of the null hypothesis for the *F*-test (*p*).

As a period of analysis we chose 2000-2012. This choice is explained by the presence of the full data for calculations. Earlier periods have lacks in data. For the calculations Statistica was used.

## 3. Findings

To confirm the dependence of the amount of pollution (for example, air emissions) upon the size of production, we have constructed a linear regression of satisfactory quality (equation (1)), with characteristics presented in Appendix in Table 1.

$$V = 6068{,}7 + 0{,}000038 * P, \quad (1)$$

where $V$ are ythe emissions of air pollutants (thous. Ton), $P$ is the industrial production (mln. UAH).

According to the regression equation (1), air emissions are in direct connection with the industrial production. So reduction of air emissions is possible only in case of proportional reduction of industrial production in Ukraine. Based on the current economic situation in Ukraine, this variant is not advisable.

Another variant of reduction of disproportions between environmental damage from emissions and actual paid environmental tax is increase of environmental tax rate. But adequate decisions about increase or reduction of environmental tax rate can be only done when potential consequences are clear.

Economics is a complicated system with variety of connections. For instance, environmental tax rate increase can lead to increase in budget revenues, capital investments in ecologically safe technologies and as the result the value of assets in the economy will grow and will cause the growth of industrial production. But on the other hand, increasing rate of environmental tax may result in higher costs of enterprises, lower profitability and potential business failure of certain types of production. As the result this will lead to a decline in GDP. There are many examples of similar conflicts and causalities.

So, adequate managerial decisions are impossible without information about possible consequences of certain actions. To get such information modeling can be used.

We provide series of calculations and get the following results explaining connections between different economic indicators (see Table 3). Characteristics of the regression equations that describe dependence between these indicators are presented in Appendix in Tables 2-12.

Table 3. List of equations describing the behavior of Ukrainian economic system after changes in environmental tax rate

| Description of dependence | Dependent variable | Independent variable | Equation |
|---|---|---|---|
| Environmental tax on air pollution upon environmental tax rate | $T$ | $t$ | $T = -9.616 + 6.90325 * t$ |
| Environmental investments upon environmental tax | $Ie$ | $T$ | $Ie = -509.653 + 5.069 * T$ |
| Capital investments upon environmental investments | $I$ | $Ie$ | $I = 66830 + 37.51 * Ie$ |
| Cost of property and equipment upon capital investments | $K$ | $I$ | $K = -432026 + 24 * I$ |
| Industrial production upon cost of property and equipment | $P$ | $K$ | $P = 456941.3 + 0.3291 * K$ |
| Enterprises costs on other taxes upon environmental tax rate | $Ctax$ | $t$ | $Ctax = 4776.15 + 89.237 * t$ |
| Enterprises key costs (salary, taxes etc) upon enterprises costs on other taxes | $C$ | $Ctax$ | $C = -139420 + 49 * Ctax$ |
| Minimal salary upon Industrial production | $S$ | $P$ | $S = -41.4862 + 0.0004 * P$ |
| Economic damage from pollution upon minimal salary and emissions of air pollutants | $D$ | $S, V$ | $D = -150154 + 382 * S + 22 * V$ |
| Emissions of air pollutants upon capital investments | $V$ | $I$ | $V = 5987.044 + 0.004 * I$ |
| Profitability of enterprises upon industrial production and enterprises key costs (salary, taxes etc.) | $r$ | $P, C$ | $r = 2.253 + 0.000025 * P - 0.00079 * C$ |

Values of coefficients of determination for all equations indicated their adequacy. The same applies to the adjusted coefficients of determination, $F$-test and the probability of the null hypothesis for the $F$-test. In addition, we evaluated the adequacy of the obtained coefficients of the equation based on the use of Student's $t$-test. The analysis results show the adequacy of the obtained equation coefficients ($p < 0.05$). To check the adequacy of the model we tested it on historical data. We calculated the indicators for the 2011 and compared them with their actual meanings in 2011. Results are presented in Table 4.

Table 4. Results of imitation for the 2011

| Indicator | Imitation data | Actual data | Divergence |
|---|---|---|---|
| **Input parameter of the model** | | | |
| Environmental tax rate | 209.1 | 209.1 | 0.0% |
| **Output parameters of the model (estimated)** | | | |
| The environmental tax on air pollution | 1433.9 | 1438.1 | 0.3% |
| Environmental investments | 6758.8 | 6451.0 | -4.6% |
| Cost of property and equipment | 7256471.0 | 7898439.0 | 8.8% |
| Industrial production | **2845046.0** | **2895283.0** | **1.8%** |
| Enterprises costs on other taxes | 23436.3 | 19944.0 | -14.9% |
| Enterprises key costs (salary, taxes etc.) | 1008961.0 | 890175.0 | -11.8% |

Table 4 (cont.). Results of imitation for the 2011

| Indicator | Imitation data | Actual data | Divergence |
|---|---|---|---|
| Minimal salary | 1096.5 | 1004.0 | -8.4% |
| Economic damage from pollution | 422515.3 | 386235.7 | -8.6% |
| Emissions of air pollutants | 7268.5 | 6877.3 | -5.4% |
| Profitability of enterprises | 3.1 | 5.9 | 2.8 |

As we can see, divergences are minimal. For example, the main component of the model – industrial production – differs only on 1.8% compared to original one. This difference is insufficient and allows to make conclusions about adequacy of this model (the main criterion of model adequacy is practice).

There are several options for practical implementation of the developed model. One way is checking the response of the economic system to a certain change of environmental tax rate with further conclusions about its appropriateness.

The most interesting and promising variant of model application is the use of imitation modeling with further optimization of the results in order to identify options that would be most appropriate and relevant to the public policy objectives. According to this approach, imitation modeling generates a bunch of alternatives of economic development, depending on the environmental tax rate. Then optimization algorithms may be used. To do this, first, the target function (e.g. profitability or industrial production) should be determined. Second, its optimization criterions (maximum, minimum or specific value) need to be chosen. Third, using the imitation modeling or mechanisms of linier or non-linier programming size of the optimal environmental tax rate can be determined.

## Conclusions

This paper provides model of macroeconomic equilibrium that describes the behavior of economic system after shocks of environmental tax rate changes. It consists of 11 equations and illustrates how certain economic indicators will change after modification of environmental tax rate. The use of this model allows to evaluate consequences of certain economic decisions of the government. Also, using the imitation modeling enables to find the optimal environmental tax rate for the specified parameters of the Ukrainian economic system.

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## Appendix

Table 1. Characteristics of the regression equation that describes dependence of the amount of air pollution upon the size of production

Regression summary for dependent variable: **Emissions to air (thousands of tons)** (Spreadsheet69) $R$ = .66680034 $R^2$ = .44462269 Adjusted $R^2$ = .38908496 $F$(1,10) = 8.0058 $p$ < .01787 Std. error of estimate: 374.86

| | Beta | Std. err. | B | Std. err. | $t$(10) | $p$-level |
|---|---|---|---|---|---|---|
| **Intercept** | | | 6068.752 | 206.8094 | 29.34467 | 0 |
| **Industrial production (mln. UAH)** | 0.6668 | 0.235664 | 0.00038 | 0.0001 | 2.82945 | 0.017869 |

Table 2. Characteristics of the regression equation that describes dependence of environmental tax on air pollution upon environmental tax rate

Regression summary for dependent variable: **Environmental tax on air pollution (mln. UAH)** (Spreadsheet48) $R$ = .99879452 $R^2$ = .99759049 Adjusted $R^2$ = .99737144 $F$(1,11) = 4554.2 $p$

| | Beta | Std. err. | B | Std. err. | $t$(11) | $p$-level |
|---|---|---|---|---|---|---|
| **Intercept** | | | -9.61604 | 10.35588 | -0.92856 | 0.373045 |
| **Environmental tax rate (UAH/ton)** | 0.998795 | 0.014800 | 6.90325 | 0.10229 | 67.48512 | 0.000000 |

Table 3. Characteristics of the regression equation that describes dependence of environmental investments upon environmental tax

Regression summary for dependent variable: **Environmental investments (mln. UAH)** (Spreadsheet69) $R$ = .97950604 $R^2$ = .95943207 Adjusted $R^2$ = .95574408 $F$(1,11) = 260.15 $p$

| | Beta | Std. err. | B | Std. err. | $t$(11) | $p$-level |
|---|---|---|---|---|---|---|
| **Intercept** | | | -509.653 | 217.4014 | -2.34430 | 0.038877 |
| **Environmental tax (mln. UAH)** | 0.979506 | 0.060729 | 5.069 | 0.3143 | 16.12917 | 0.000000 |

Table 4. Characteristics of the regression equation that describes dependence of capital investments upon environmental investments

Regression summary for dependent variable: **Capital investments (mln. UAH)** (Spreadsheet69) $R$ = .92549509 $R^2$ = .85654117 Adjusted $R^2$ = .84349945 $F$(1,11) = 65.677 $p$

| | Beta | Std. err. | B | Std. err. | $t$(11) | $p$-level |
|---|---|---|---|---|---|---|
| **Intercept** | | | 66830.08 | 14646.67 | 4.562819 | 0.000813 |
| **Environmental investments (mln. UAH)** | 0.925495 | 0.114200 | 37.51 | 4.63 | 8.104138 | 0.000006 |

Table 5. Characteristics of the regression equation that describes dependence of cost of property and equipment upon capital investments

Regression summary for dependent variable: **Cost of property and equipment (mln. UAH)** (Spreadsheet69) $R$ = .78643588 $R^2$ = .61848140 Adjusted $R^2$ = .58379789 $F$(1,11) = 17.832 $p$

| | Beta | Std. err. | B | Std. err. | $t$(11) | $p$-level |
|---|---|---|---|---|---|---|
| **Intercept** | | | -432026 | 989459.1 | -0.436629 | 0.670828 |
| **Capital investments (mln. UAH)** | 0.786436 | 0.186235 | 24 | 5.6 | 4.222813 | 0.001430 |

Table 6. Characteristics of the regression equation that describes dependence of industrial production upon cost of property and equipment

Regression summary for dependent variable: **Industrial production (mln. UAH)** (Spreadsheet69) $R$ = .93110939 $R^2$ = .86696469 Adjusted $R^2$ = .85366116 $F$(1,10) = 65.168 $p$ < .00001 Std. error of estimate: 3232E2

| | Beta | Std. err. | B | Std. err. | $t$(10) | $p$-level |
|---|---|---|---|---|---|---|
| **Intercept** | | | 456941.3 | 141627.3 | 3.226364 | 0.009077 |
| **Cost of property and equipment (mln. UAH)** | 0.931109 | 0.115341 | 0.3291 | 0.0 | 8.072671 | 0.000011 |

Table 7. Characteristics of the regression equation that describes dependence of minimal salary upon industrial production

Regression summary for dependent Variable: **Minimal salary (UAH)** (Spreadsheet69) $R$ = .98491815 $R^2$ = .97006375 Adjusted $R^2$ = .96707013 $F$(1,10) = 324.04 $p$ <. 00000 Std. error of estimate: 56.912

| | Beta | Std. err. | B | Std. err. | $t$(10) | $p$-level |
|---|---|---|---|---|---|---|
| **Intercept** | | | -41.4862 | 31.39807 | -1.32130 | 0.215834 |
| **Industrial production (mln. UAH)** | 0.984918 | 0.054714 | 0.0004 | 0.00002 | 18.00120 | 0.000000 |

Table 8. Characteristics of the regression equation that describes dependence of emissions of air pollutants upon capital investments

| Regression summary for dependent variable: **Emissions of air pollutants (thousands of tons)** (Spreadsheet69) $R$ = .83533739 $R^2$ = .69778856 Adjusted $R^2$ = .67031479 $F(1,11)$ = 25.398 $p$ | | | | | | |
|---|---|---|---|---|---|---|
| | **Beta** | **Std. err.** | **B** | **Std. err.** | ***t*(11)** | ***p*-level** |
| **Intercept** | | | 5987.044 | 140.1473 | 42.71965 | 0.000000 |
| **Capital investments (mln. UAH)** | 0.835337 | 0.165752 | 0.004 | 0.0008 | 5.03968 | 0.000378 |

Table 9. Characteristics of the regression equation that describes dependence of economic damage from pollution upon minimal salary and emissions of air pollutants

| Regression summary for dependent variable: **Economic damage from pollution (mln. UAH)** (Spreadsheet69) $R$ = .98465916 $R^2$ = .96955366 Adjusted $R^2$ = .96346439 $F(2,10)$=159.22 $p$ < .00000 Std. error of estimate: 27602. | | | | | | |
|---|---|---|---|---|---|---|
| | **Beta** | **Std. err.** | **B** | **Std. err.** | ***t*(10)** | ***p*-level** |
| **Intercept** | | | -150154 | 129652.8 | -1.15812 | 0.273726 |
| **Minimal salary (UAH)** | 0.943482 | 0.066624 | 382 | 27.0 | 14.16128 | 0.000000 |
| **Emissions of air pollutants (thousands of tons)** | 0.070392 | 0.066624 | 22 | 20.7 | 1.05655 | 0.315571 |

Table 10. Characteristics of the regression equation that describes dependence of enterprises costs on other taxes upon environmental tax rate

| Regression summary for dependent variable: **Enterprises costs on other taxes (mln. UAH)** (Spreadsheet48) $R$ = .92580818 $R^2$ = .85712079 Adjusted $R^2$ = .84283287 $F(1,10)$ = 59.989 $p$ | | | | | | |
|---|---|---|---|---|---|---|
| | **Beta** | **Std. err.** | **B** | **Std. err.** | ***t*(10)** | ***p*-level** |
| **Intercept** | | | 4776.157 | 1008.274 | 4.736962 | 0.000796 |
| **Environmental tax (UAH/ton)** | 0.925808 | 0.119532 | 89.237 | 11.521 | 7.745269 | 0.000016 |

Table 11. Characteristics of the regression equation that describes dependence of enterprises key costs (salary, taxes etc.) upon enterprises costs on other taxes

| Regression summary for dependent variable: **Enterprises key costs (salary, taxes) (mln. UAH)** (Spreadsheet69) $R$ = .99435934 $R^2$ = .98875049 Adjusted $R^2$ = .98762554 $F(1,10)$ = 878.93 $p$ | | | | | | |
|---|---|---|---|---|---|---|
| | **Beta** | **Std. err.** | **B** | **Std. err.** | ***t*(10)** | ***p*-level** |
| **Intercept** | | | -139420 | 19866.13 | -7.01797 | 0.000036 |
| **Enterprises costs on other taxes (mln. UAH)** | 0.994359 | 0.033540 | 49 | 1.64 | 29.64671 | 0.000000 |

Table 12. Characteristics of the regression equation that describes dependence of profitability of enterprises upon industrial production and enterprises key costs (salary, taxes, etc.)

| Regression summary for dependent variable: **Profitability of enterprises** (Spreadsheet69) $R$ = .64434334 $R^2$ = .41517834 Adjusted $R^2$ = .28521798 $F(2,9)$ = 3.1947 $p$ < .08946 Std. error of estimate: 1.2573 | | | | | | |
|---|---|---|---|---|---|---|
| | **Beta** | **Std. err.** | **B** | **Std. err.** | ***t*(10)** | ***p*-level** |
| **Intercept** | | | 2.253010 | 1.225642 | 1.83823 | 0.099190 |
| **Industrial production (mln. UAH)** | 14.4040 | 5.714296 | 0.000025 | 0.000010 | 2.52070 | 0.032731 |
| **Enterprises key costs (salary, taxes, etc.) (mln. UAH)** | -14.3417 | 5.714296 | -0.000079 | 0.000031 | -2.50980 | 0.033322 |