MODELLING CORPORATE INCOME TAX REVENUES IN LATVIA

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Abstract: *The article is devoted to the issues of modelling and forecasting corporate income tax revenues in Latvia. Analysis of legal aspects and data shows that it is necessary to distinguish between advance payments (usually monthly payments) and final tax payments made in March, April or May. Following the usual practice, both identities and econometric equations are estimated for forecasting the corporate income tax revenues. Such factors as profit, private consumption price index, exports, wages, private consumption and investment are used as the factors along the tax rate. It is possible to use estimated monthly econometric equation for the short-term forecasting as it provides reasonably precise results and demands less assumptions as the other proposed models, but forecasts should be evaluated together with the results of identities. Estimated equations have to be applied together with the reliable models of influencing factors. The research findings are valuable for other countries as corporate income tax is a standard tax in fiscal system in all EU and other countries.*

Keywords: *Corporate income tax revenues, Tax revenues modelling, Tax revenues forecasting, Factors, Latvia.*

JEL Classification: *C51, C52, H25, H68.*

Introduction

Government budget planning process in Latvia as in any other country implies the estimation of the government expenditures and revenues, which are balanced with the respect of a particular budget surplus or deficit, usually expressed as % of GDP. Thus it is very important to get plausible estimates of the revenues, because otherwise expenditures would turn out to be too high and would not allow reaching the budget deficit target, or expenditures would turn out to be too low, hindering economic growth.

The main taxes in Latvia from the point of view of government revenues are social contributions, value added tax, personal income tax, excise taxes and corporate income tax. Payments of most of the main taxes are calculated when the value of tax base is clear. Depending on the status of tax payers, these taxes are usually paid on monthly or quarterly basis as final tax payments, although advance payments are also possible.

On the other hand, corporate income tax payments are mostly advance payments and actual tax base is used only for calculation of the final tax payment after the annual report of the company is filed in the State Revenue Service. Advance payments are calculated, taking into account previous tax payments and changes in price level, however, adjustments are also possible, if a company becomes more profitable or faces difficulties in its operation. Therefore it is not easy to make plausible monthly corporate income tax revenues forecasts.

Literature review shows that the research related to the corporate income tax is more often related to the effects of the tax rate on the economic growth (see (Macek

2015) for more details) and capital structure (Kedzior 2012) or the effects of tax competition (Griffith et al. 2014), unification of tax base in the EU (Oestreicher & Koch 2011) and the activities of multinational enterprises (Haufler et al. 2008; Hong & Smart 2010; Eichner & Runkel 2011; Keuschnigg & Devereux 2013). There are also studies that focus on changes in tax legislation showing the positive impact of actual or potential tax reforms (Masso et al. 2013; Azacis & Gillman 2010). There are even studies like (Acosta-González et al. 2014), which use taxes, including the corporate income tax, to determine the level of the shadow economy. Less attention is paid to the modelling of tax revenues as such. Interesting conclusion can be found in (Buettner & Kauder 2010), which states that the revenue forecasts are more accurate, if they are independent from the government manipulation.

The aim of the article is to evaluate several models of the corporate income tax revenues and their possible use for short-term forecasting. Monthly data of January 1995-December 2016 provided by the Treasury of Latvia (Treasury 2017) are used to develop monthly and quarterly models. Annual data of 1995-2015 provided by the Central Statistical Bureau (CSB) of Latvia (CSB 2017) together with the data of the Treasury are used for the annual model. The same samples are used for factors needed in the models unless smaller dataset is available in the CSB database.

1 Statement of a problem

The system of taxes and duties in Latvia is regulated by the law On Taxes and Duties and laws related to particular types of taxes (Ministry of Finance 2017). The main laws regulating corporate income tax are law On Corporate (Enterprise) Income Tax and Micro-enterprise Tax Law. These laws include also significant information for modelling and forecasting tax revenues such as tax base, tax rates, dates of payments etc. Also the changes in legal acts can be significant and thus also influence the modelling process.

Corporate income tax is paid by all the enterprises in Latvia, except several charities. Tax base is profit, which is calculated according to the law. For residents the tax base includes all income received both domestic and abroad, for non-residents it includes only particular income types or income from commercial activities. Profit stated in the annual report of enterprises is raised by several groups of expenditures like representation, operations in stock market etc. Profit is lowered by other tax payments, specific charity, research expenditures etc. Income for selling fixed assets can be deducted from the profit, if the money is invested in new fixed assets. To facilitate investments, since 2006 additional coefficient of amortization is used, this results in a smaller taxable income. Before 2006 tax relieves on investment were used. Till 2013 additional coefficients on amortization were used also to facilitate regional development. Investment activities are facilitated also by tax relieves on initial investment in particular projects (once in 10 years), which can be used in 16 years, if tax payment is smaller than tax relief. Taxable income can also be used to cover losses from the previous years.

Corporate income tax rate is 15% and it is stable since the 2004, when it replaced the previous rate of 25%. For non-residents tax rate varies between 2% and 30% depending on the income type. Taxes on income paid in other countries are deducted from the tax payments to the extent to which they would be paid in Latvia. Tax is paid

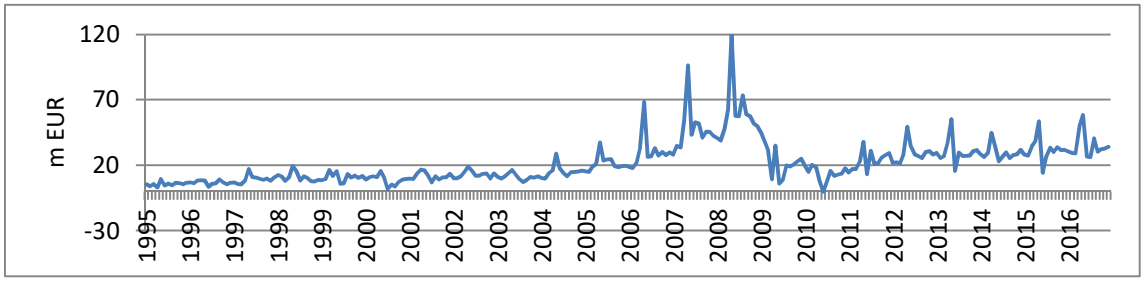
in 15 days after the annual report is filed. According to the Annual Report Law, annual reports can be filed to the State Revenue Service not later than one month after the annual report has been approved and not later than 4 months after the end of the year.

Advance payments are made mostly on monthly basis. The amount of advance payments is calculated, taking into account tax payments with 2 years / 1 year lag (depending on the date when annual report is filed) and official consumption price index in the previous year, but exceptions are possible. Advance payments, which exceed calculated tax payment can be transferred to tax liabilities, to future tax payments or paid back within 30 days.

In addition, if the enterprise is a micro-enterprise tax payer and limited liability company, 1.9% (till 2016 4.9%) of micro-enterprise tax revenues are transferred to the corporate income tax revenues account. Micro-enterprise tax base is annual turnover and revenues of employees, if they exceed 720 EUR. Since 2017, micro-enterprise tax rate is 15% (previously 9% in the first 3 years of operation, afterwards 12%), if there are 5 employees or less in the enterprise. The rate increases by 2%points for each additional employee. The rate is 20% for the turnover, which exceeds 100 000 EUR. Micro-enterprise tax is paid each quarter till the 15th day of the subsequent month. As CSB uses different criteria for classification of the enterprises, it is not possible to determine the significance of micro-enterprises and thus quarterly payments of corporate income tax. However, it is known that the share of micro-enterprise tax revenues in corporate income tax revenues is small and thus should not considerably influence the structure of the tax payments within the year.

Dynamics of monthly revenues of corporate income tax is shown in Figure 1. We can see that the revenues are usually higher in May, but in other months revenues usually do not differ much. The main reason is that final corporate income tax payments are paid after the annual reports are filed, which can be as late as in May and depends on profit, but advance payments are calculated based on the tax payments in the previous years. Although advance payments can be adjusted taking into account the performance of enterprises, it is nevertheless hard to predict the actual profits, which often leads to higher final payments of the corporate income tax.

Fig. 1: Corporate Income Tax Revenues in Latvia in 2005-2016, m EUR



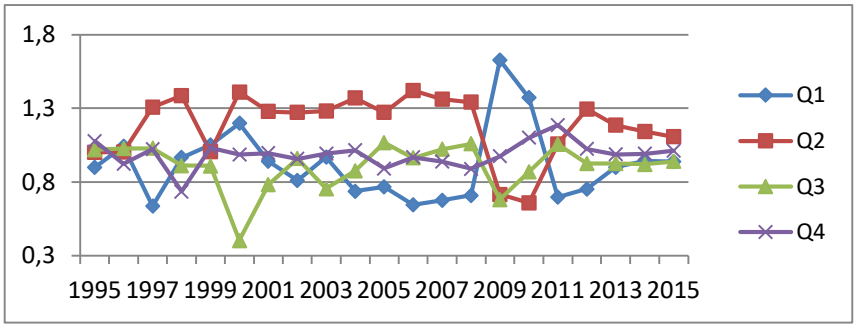
Source: Authors' own elaboration according to (Treasury 2017)

Seasonal patterns of different kinds are usually analysed using seasonality indexes. In this case seasonality indexes were calculated by dividing the revenues in each month or quarter by the average monthly or quarterly revenues in each year. Quarterly pattern of the corporate income tax is not very explicit and stable (see Figure 2). However, the general trend is that the 1st quarter comes with lower values, the 2nd quarter has the highest values, but the 3rd and 4th quarters are in the middle. Increase in

the value of seasonal index for the 1st quarter and decrease for the 2nd quarter after 2013 may indicate that the advance payments are lately estimated more precisely.

Analysis of monthly seasonal indexes argues that there is no strong evidence of the higher tax revenues in the first month in each quarter, therefore monthly payments of corporate income tax dominate over quarterly payments. The highest values of seasonal indexes are usually associated with May. However in some cases the values are high also in April and March and during the economic crisis (in 2008-2010) also in January and February.

Fig. 2: Quarterly Seasonal indexes of the corporate income tax revenues in Latvia in 1995-2015



Source: Authors' own elaboration according to (Treasury 2017)

Analysis of the seasonal indexes indicates that it is necessary to distinguish among advance payments and final payments when modelling corporate income tax revenues. Moreover, final payments should be related to May in most cases or spread among March, April and May.

2 Methods

One of two main approaches can be applied for tax revenues modeling. It is possible to use identities, where effective tax rate or coefficient, characterizing tax rate, is multiplied by appropriate tax base. Traditionally tax base is endogenous and tax rate – exogenous (Willman & Estrada 2002). Moreover, effective tax rate is calculated as a ratio of tax revenues and tax base. In case of corporate income tax revenues, tax base can be profit of enterprises (Willman & Estrada 2002; Livermore 2004) or gross operating surplus (Kattai 2005). In macroeconomic models profits are usually calculated similar as gross operating surplus – GDP minus earnings of employees (wages multiplied by number of employees) minus indirect taxes.

The second approach is based on the estimation of econometric equations, which usually include tax base as the main factor. Econometric equations make it possible to use a wider range of influencing factors, including tax rates officially stated in legal acts and tax reliefs (Ozoliņa & Pocs 2013). Also mixed approach can be used – identities can be used for calculation of tax revenues and econometric equations for calculation of efficient tax rate.

In the quarterly and monthly level, data on profits are not available, therefore it is necessary to understand, what factors influence profits. From the macroeconomic point of view, profits before taxes can be calculated as investment minus non-business saving plus dividends and corporate profits taxes. Moreover, sources of profits determine profits (Levy et al. 2008). It means that sources of profits or even factors

influencing the sources of profits can be used to model corporate income tax revenues. For example, investment, exports, imports and price levels can be used as the factors.

3 Problem solving

Within the research, models are made in 3 levels – monthly, quarterly and annual. The Treasury data (national classification) are used in monthly and quarterly calculations and CSB data (ESA 2010 classification) are used in annual calculations.

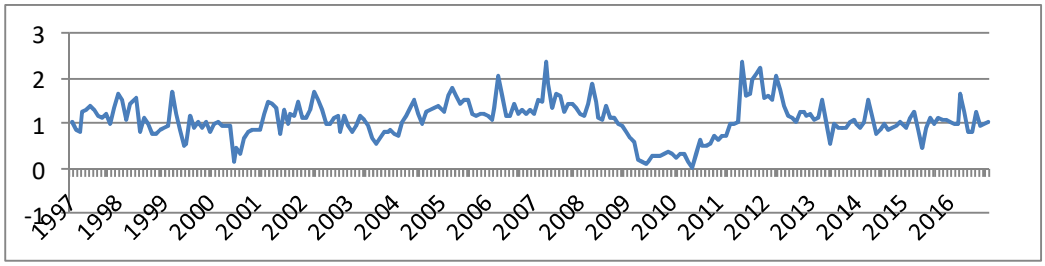
Two options can be used for modelling monthly revenues of corporate income tax. The first option is related to the official regulations – the way advance payments and final payment of taxes are usually calculated and afterwards paid in the budget. Equation (1) shows that monthly revenues of corporate income tax are influenced by the tax payments made in the previous two years adjusted for inflation and profit in the previous year. It should be noted that advance payments from January to May are influenced by the tax payments made 2 years ago, but from June to December – by the tax payments made 1 year ago. Profit is taken into account only in May, when final calculations are made.

$$CITR = coefmon * CITRlag *(1 + PCIinfl/100)/12 + coefmay *PROFlag/100, \quad (1)$$

where *CITR* – corporate income tax revenues; *CITRlag* – annual corporate income tax revenues with 6-17-month lag (for example, in June 2015 to May 2016 the value of annual corporate income tax revenues of 2014 is used); *coefmon* – corporate income tax advance payments coefficient; *PCIinfl* – annual growth rate of private consumption price index in the previous year; *coefmay* – corporate income tax revenues coefficient applied only in May; *PROFlag* – annual profit in the previous year.

The values of the corporate income tax advance payments coefficient fluctuates around 1 (see Figure 3).

Fig. 3: Dynamics of the Corporate Income Tax Advance Payments Coefficient in Latvia in 2005- 2016

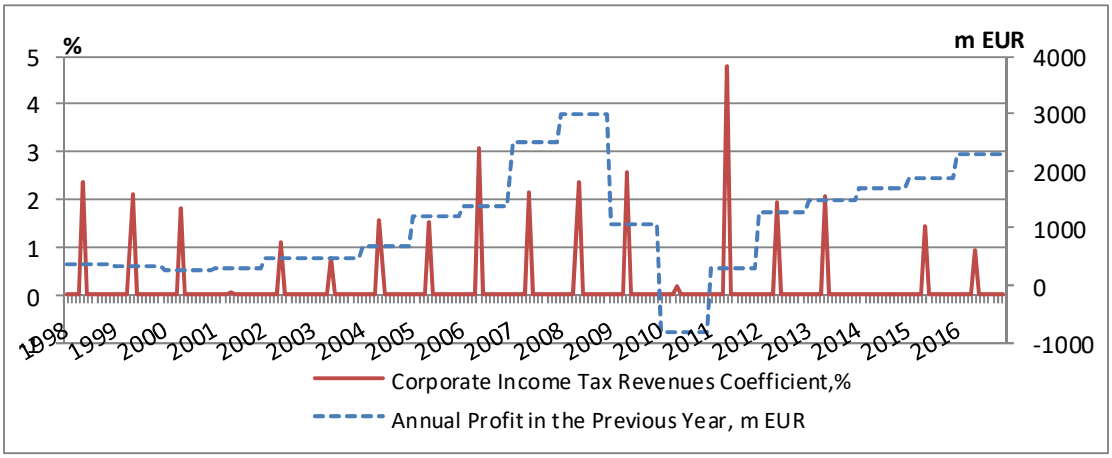


Source: Source: Authors' calculations

If the value of the coefficient is less than 1, advance payments are downward adjusted and/or taxes are not paid in due time and companies are closing their business. If the value of the coefficient is larger than 1, advance payments are upward adjusted and/or new tax payers arise (new companies, more non-residents etc.). The values are comparatively low during the global economic crisis and comparatively high in 2012 – just after the crisis. The corporate income tax revenues coefficient (applied in May) basically shows what part of tax payments is not covered by the advance payments. The average value of the coefficient in 1998-2013 is 1.9, which means that approximately 10% of tax payments are not covered by the advance payments (afterwards this share decreases). Exception can be seen in 2010, when the

final payment should have been a negative number (money paid back or reserved for the future tax payments). The value of the coefficient is actually positive, because in total companies were working with losses in 2010. Figure 4 shows that the general trend is that the values of the corporate income tax revenues coefficient increase, when profit tends to increase and vice versa.

Fig. 4: Dynamics of the Corporate Income Tax Revenues Coefficient and Annual Profit in Latvia in 1998- 2016



Source: Authors' own elaboration according to (Treasury 2017; CSB 2017)

If the equation (1) is used for forecasting, only values of two macroeconomic indicators have to be estimated before, as well as two coefficients. However, profit is a tricky variable to forecast. Therefore alternative approaches should be used as well. Thus for econometric equation other macroeconomic variables available monthly were tested. Econometric equation (2) was estimated, taking into account that both advance payments and final payment of corporate income tax is based on the past information – with the lag of 6 up to even 24 month. But the payments are adjusted following the recent trends, therefore 12 month was chosen as a maximum lag. Exports, personal consumption and wages were chosen as the factors influencing the profit.

$$\ln(CITR) = \alpha + \beta_1 \ln(PCI(-12)) + \beta_2 6\ln(EX(-12)) + \beta_2 \ln(EX(-3)) + \\ + \beta_4 DFP^* \ln(EX(-12)) + \beta_5 \ln(W\_NOM(-7)) + \beta_6 TAXR + \beta_7 D\_00 + \\ + \beta_8 D\_09 + \beta_9 D\_10\_C^* \ln(W\_MIN(-12)), \quad (2)$$

where *CITR* – corporate income tax revenues; *PCI* – private consumption price index; *EX* – exports; *W_NOM* – gross nominal wages; *TAXR* – corporate income tax rate; *W_MIN* – minimum wage; *DFP* – dummy of final payments (0.3-1 in March, April and/or May, 0 otherwise); *D_00* – dummy (June to September 2000 = 1, 0 otherwise); *D_09* – dummy (April to July 2009 = 1, 0 otherwise); *D_10_C* – dummy (since 2010 = 1, 0 otherwise).

Several final payment dummies were tested in order to get more precise results, because, for example, in 2014 higher corporate income tax revenues were collected in April and not in May, as before. Therefore seasonal indexes were analysed in order to determine, whether final tax payments could be made also in April or March. Two types of dummies were tested – traditional ones with the values 0 or 1 (for March, April or May, in case the value of seasonal index was relatively high) and "cumulative effect" dummies, where the total value of dummy for final payments was split among

the months (the sum of this dummy is 1 in each year). The "cumulative effect" dummy was chosen, as it ensured a better fit (see the estimated coefficients in Table 1).

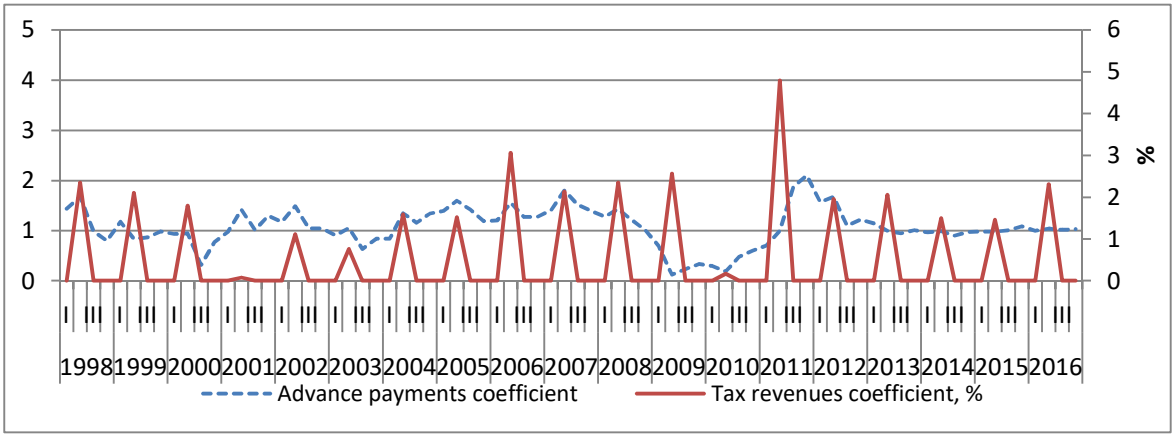
Tab. 1: OLS Models of Corporate Income Tax Revenues of Latvia

Monthly Equation, dependent variable ln(*CITR*)		**Quarterly Equation, dependent variable ln(*CITR*)**		**Annual Equation, dependent variable ln(*CITR/PCI*)**	
Variable	Coefficient, significance	Variable	Coefficient, significance	Variable	Coefficient, significance
const.	0.04	const.	-6.0 *	const.	-4.2 *
ln(*PCI*(-12))	-2.64 *	ln(*INV*)	0.38 *	log(*INV_FP*(-1))	0.64 *
ln(*EX*(-12))	0.64 *	ln(*INV*(-4))	0.60 *	*D_10*	-0.61 **
ln(*EX*(-3))	0.84 *	ln(*INV*(-8))	-0.68 *		
*DFP**ln(*EX*(-12))	0.16 *	*@seas(2)**ln(*INV*(-2))	0.04 *		
ln(*W_NOM*(-7))	0.86 *	ln(*CONS*(-2))	0.96 *		
TAXR	4.68 *	*TAXR*	3.31 **		
D_00	-0.87 *				
D_09	-1.07 *				
*D_10_C**ln(*W_MIN*(-12))	-0.13 *				
R^2adj	0.86	R^2adj	0.87	R^2adj	0.71
DW	1.88	DW	1.63	DW	1.55
** denotes significance at 1% level, ** at 5% level					

Source: Authors' calculations

In the initial equation there were comparatively large residuals in 2000 and 2009, which suggested that the periods of the crisis could be withdrawn from the estimation sample. Therefore two additional dummies were used in equation (2).

Fig. 5: Dynamics of Corporate Income Tax Coefficients in Latvia in 2005-2016



Source: Authors' calculations

In quarterly calculations equation (1) adjusted to quarterly data is used for identity-based modelling. The values of corporate income tax advance payments coefficient and corporate income tax revenues coefficient (for final payments) are shown in Figure 5. The values of the tax revenues coefficient related to the final tax payments are taken from the monthly calculations (in 2014 and 2016 the values are adjusted due to the high revenues in April). The values of the advance payments coefficients are calculated the same way as in the monthly calculations, but in the 2nd quarter they are adjusted taking into account the values of the final payments. With the exception of 2009-2012, the values of advance payments coefficients are relatively stable.

As an alternative, equation (3) was estimated using private consumption expenditures and investment as the main factors. The idea behind the factor choice is similar as in monthly calculations – to choose variables, which characterize economic development and thus show, how advance payments can be adjusted.

$$\ln(CITR) = \alpha + \beta_1 \ln(INV) + \beta_2 \ln(INV(-4)) + \beta_3 \ln(INV(-8)) + \\ + \beta_4 @seas(2) * \ln(INV(-2)) + \beta_5 \ln(CONS(-2)) + \beta_6 TAXR, \quad (3)$$

where *CITR* – corporate income tax revenues; *INV* – gross capital formation; *CONS* – private consumption expenditures; *TAXR* – corporate income tax rate; *@seas(2)* – dummy of the 2nd quarter (1=2nd quarter, 0 – otherwise). See the estimated coefficients in Table 1.

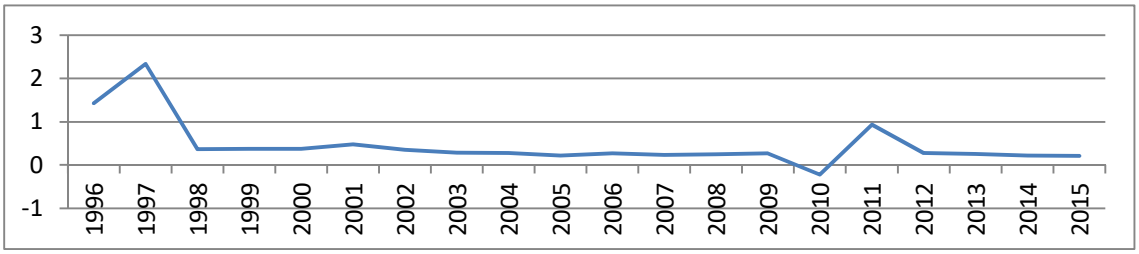
Annual models usually reveal medium and long-term trends and relationships among economic variables. Therefore short-term forecasts by annual models are not always very accurate. As a result identities (the same as in the quarterly calculations) are preferred in annual level, if the values of exogenous indicators are reasonably stable and thus predictable. On the other hand, if the tax base is not easy to predict, econometric equations may prove useful. Using annual data and identity approach corporate income tax revenues can be calculated with the equation (4) with profit in the previous year as the tax base (tax rate is not used here, as it is relatively stable and changes are not planned in near future, only the tax rate coefficient which can be interpreted as the effective tax rate).

$$tax\_rev = taxr\_coef * tax\_base, \quad (4)$$

where *tax_rev* – tax revenues; *taxr_coef* – tax rate coefficient; *tax_base* – tax base.

The values of the tax rate coefficient are relatively stable (see Fig.6), however the pattern changes dramatically in 2010-2011, which can be attributed to the effects of the crisis.

Fig. 6: Dynamics of the Tax Rate Coefficient of the Corporate Income Tax in Latvia in 1996-2015



Source: Authors' calculations

In order to obtain alternative forecasts econometric equation (5) was estimated using investment in the previous year as a factor.

$$\ln(CITR/PCI) = -4.2 + 0.6 \ln(INV\_FP(-1)) - 1.0 D\_10, \quad (5)$$

where *CITR* – corporate income tax revenues; *PCI* – private consumption price index; *INV_FP* – gross capital formation at constant prices; *D_10* – dummy (in 2010 = 1; 0 – otherwise). See the estimated coefficients in Table 1.

The final modelling step in annual calculations is to transfer forecasts from ESA 2010 methodology to the national methodology in order to use the forecasts in national

budget planning. For this purpose simple coefficient is used. In case of the corporate income tax revenues, the value of this coefficient is close to 1 (0.99 on average in 1995-2015). Further the quarterly and annual values can be transferred to monthly projections using seasonal indexes.

4 Results and Discussion

Precision of forecasts generally depends on two things – the reliability of the chosen method and on the assumptions regarding exogenous indicators and coefficients. In case of identity-based approach, it is not possible to estimate the accuracy of the future values of exogenous indicators. However, in case of econometric equations it is possible to check, whether their previous performance results in accurate forecasts. For this purpose chosen equations were estimated till the end of 2014 (Month 14 and Quarter 14) and till the end of 2015 (Month 15 and Quarter 15) and then forecasts were calculated till the December of 2016. The monthly forecasts were aggregated to quarterly forecasts and the accuracy of forecasts was evaluated using Mean Absolute Percentage Error[1] (MAPE) as a criterion (see Table2).

Tab. 2: Mean Absolute Percentage Errors of Quarterly Forecasts, %

Period	Month 14	Month 15	Quarter 14	Quarter 15
2015	7.7	x	3.7	x
Q1	5.5	x	1.0	x
Q2	17.1	x	5.0	x
Q3	2.1	x	6.4	x
Q4	6.2	x	2.4	x
2016	7.2	6.6	13.3	13.2
Q1	13.0	9.9	8.5	8.2
Q2	9.3	11.0	14.8	15.0
Q3	0.4	2.0	16.6	16.3
Q4	5.9	3.3	x	x

x – no results possible due to the method applied

Source: Authors' calculations

From the Table 2 we can see that if the equations are estimated using data till the end of 2014, quarterly equation gives more precise results for 2015. Critical period is the 2nd quarter, where the value of MAPE is very high for monthly equation (17.1%) due to the unexpectedly low corporate income tax revenues in June (almost half as much as forecasted and as in July, which is the next smallest revenue value in 2015). In quarterly forecasts the value of MAPE was comparatively high in the 2nd (5.0%) and the 3rd (6.4%) quarters. However, in 2016 monthly equations give better results, except in the 1st quarter. It means that econometric equations can be used for forecasting; however obtained forecasts for the 1st and the 2nd quarter have to be adjusted, using results from other models or expert evaluations.

[1] Formula of MAPE is: $MAPE = \frac{1}{n}\sum_{t=1}^{n}\frac{|\varepsilon_t|}{y_t}\cdot 100$, where ε_t – error, y_t – actual data, n – number of errors

Tab. 3: Mean Absolute Percentage Errors of Annual Forecasts, %

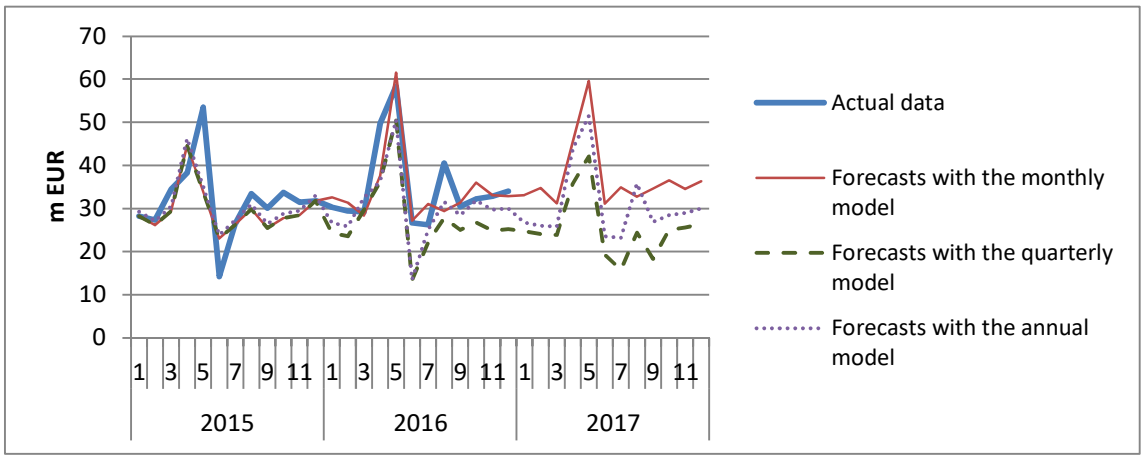
Model	2015	2016
Month 14	8.1	1.3
Month 15	x	1.1
Quarter 14	1.0	10.4
Quarter 15	x	10.3
Year 14	4.6	13.2
Year 15	x	12.9

x – no results possible due to the method applied

Source: Authors' calculations

Similar procedure was carried out for annual forecasts. Annual econometric model was estimated till 2014 and 2015, and then forecasted for 2015 and/or 2016. It was assumed that the tax revenues in both national and ESA 2010 classifications do not differ. MAPE of this forecast (Year 14) in 2015 is 4.6% (see Table 3), which is relatively small, but higher than for quarterly forecasts in 2015. However, in 2016 both annual forecasts (Year 14 and Year 15) are the least precise of all. Monthly equations provide quite accurate annual forecasts in 2016. This may mean that 2016 may include important structural changes or export should be tested as a factor influencing the corporate income tax revenues also in quarterly and annual models. Indeed, annual econometric equation with exports as the main factor helps reducing the value of MAPE to 2.8% in 2015 and 7.8-8.5% in 2016; however with the quarterly data it was not possible to specify a more precise equation using exports as a factor.

Fig. 7: Forecasts of Corporate Income Tax Revenues in Latvia using Econometric Models in 2014-2017



Source: Authors' calculations

Monthly forecasts of corporate income tax revenues obtained by the econometric equations for 2015-2017 are given in Figure 7.We can see that the quarterly model gives comparatively more pessimistic forecasts already in 2016, which indicates that other alternatives should be used instead. Monthly econometric model gives more precise forecasts for 2016, as it uses only the actual data. In 2017 these forecasts are the most optimistic ones.

As the analysis of MAPE showed, econometric equations tend to be too optimistic or pessimistic in the 1st and the 2nd quarter, therefore it is advisable to use mixed

forecasts – monthly econometric forecasts mixed with the quarterly and/or annual forecasts using identities, as well as expert evaluations.

Conclusions

It is possible to use the estimated monthly econometric equation for the short-term forecasting as it provides reasonably precise results and demands less assumptions as other proposed models, but it has to be evaluated together with the results of the identities, involving additional assumptions regarding advance payments and final tax payments coefficient. For the quarterly and annual econometric equations a more appropriate combination of factors or alternative factors should be considered. The use of the annual identity depends on the credibility of the future estimates of the profit, which is a comparatively complicated indicator to forecast. Estimated equations have to be applied together with the reliable models of influencing factors. The proposed equations should be tested each year and additional factors should be considered in case the tax laws change which influence the tax base and/or effective tax rate. The research findings are valuable for other countries as corporate income tax is a standard tax in fiscal system in all EU and other countries.

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