CHAPTER 4

QUANTITATIVE FISCAL ANALYSIS IN KAZAKSTAN

SALLY WALLACE

INTRODUCTION

In all countries, quantitative fiscal analysis—objective, accurate and timely quantitative analysis of the budget, intergovernmental fiscal relations, and revenue and expenditure changes— is essential to a smoothly functioning government.[1] Two specific types of fiscal analysis, revenue forecasting and revenue estimation, receive a great deal of attention in developed countries. A third analysis of changes in intergovernmental fiscal relations, is highly relevant for the current situation in Kazakstan.

Revenue forecasting refers to the projection of budget revenue under a given tax structure, as set forth by law. Such forecasts are typically used in the budgetary process to determine future budget balances, constraints on expenditures, requirements for debt financing, and revenue-sharing allocations.

Revenue estimation, on the other hand, traditionally refers to the estimation of how a change in the tax structure affects the amount of revenues received. Such revenue effects may then be projected into the future. Revenue estimates are used to inform policymakers of the impacts of various changes in the tax law on revenue of central and subnational levels of government. Revenue estimates may be reported on an aggregate basis (total effect on revenue) or, inter alia, by sectors, types of taxpayers, levels of government, and so on. Other types of fiscal analysis include estimation of the impact of changes in the macroeconomy on the

[1] This chapter focuses on the need for particular types of quantitative fiscal analysis. It is not intended to be comprehensive; a fiscal analysis unit would do other types of analysis and, thus, would have economic, legal, and administrative competence.

budgets of central and subnational governments and estimation of the impacts of government fiscal policy on savings and investment.

Changes in intergovernmental fiscal relations need to be analyzed to understand how changes in various institutional arrangements, such as expenditure assignment, tax assignment, and grant formulas, would affect the budgetary position of national and subnational governments.

The capacity to perform systematic and accurate analysis of the impact of fiscal policy on budgets of central and subnational governments, as well as on the economy in general, is crucial in all countries, but this is especially true in countries in transition for three reasons. First, because there was little need for fiscal analysis under the planned economic system, there is a lack of "fiscal analysis infrastructure" and trained analysts using sophisticated computer technology.[2] In a market economy, fiscal policy affects the economy in many ways, and it is necessary to understand the implications of any policies that might be adopted.

Second, in Kazakstan, as in other transitional countries, there is a strong linkage between the budgets of the central and subnational governments. Tax sharing and other grants systems in Kazakstan make subnational governments heavily dependent on the central government. Changes in central government fiscal policy, thus, have significant implications for the fiscal condition of the subnational governments. For example, a change in the VAT rate or in VAT exemptions will change revenues that both the central government and the subnational governments would receive from VAT. Therefore, both levels of government have much at stake in the development of the capacity to perform fiscal analysis and in the actual methods of analysis used.[3]

It is imperative that subnational governments also have the capability to estimate the impacts of changes in tax law and revenue-sharing arrangements at both the central and subnational levels, or at least to have confidence in the forecasts and estimates of the central government. These issues call for the development of fiscal

[2] Under the former planned economic system, fiscal policy had little impact on the economy. The government guaranteed employment and controlled prices and wages, and economic forces were not allowed to play the role that they play in a market economy.

[3] In some developed countries such as the US, the budgetary interdependence between the federal and subnational governments is less than in Kazakstan. In the US, much of the fiscal analysis at the federal level is conducted independently of that for the states. Most state governments invest in their own fiscal analysis units, which have their own methods of analysis, but rely on the federal government for some data.

analysis units at various levels of government, including central, *oblast*, and in many cases, *rayon*.[4] Additionally, in some countries, fiscal analysis units exist in both the legislative and executive branches of government.[5] This allows a system of checks and balances that can be helpful in furthering the public debate on fiscal issues. A type of synergism can develop whereby analysts for the two branches constructively discuss and debate analytical methods and outcomes of various fiscal policies.

Finally, Kazakstan was not even an independent country until 1991. Therefore, there was little need for fiscal analysis until very recently. The country did not have to deal with such issues as the establishment of tax laws, revenue sharing between the central and subnational governments, and the impact of economic factors on the overall level of revenue generated in the country.

The changes to the tax code that are discussed in Chapter 3, as well as the recommendations for tax sharing, tax surcharges, and grants in Chapters 7-10, provide obvious examples of the need for revenue estimation capabilities. Without knowledge of the impacts of changes in the revenue-sharing rules and the effects of surcharges and grants, neither the central government nor the subnational governments can adequately prepare their budgets.

In Kazakstan, all levels of government have some stake in revenue forecasting due to the tax-sharing arrangements. However, because the central government forecasts the expected revenue for subnational governments so that it can determine sharing rates, the subnational governments in practice have little option but to accept the forecasts of the central government. In some cases, the *oblast* may try to negotiate with the central government regarding its forecast, but this tends to make little difference to the plan of the central government.[6] Therefore, it is less important that each level of government understand the forecasting methodology of the other than is the case for revenue estimation. In some respects, this is similar to countries where there is less dependence of one level of government on another, such as the US.

Currently, the general fiscal analysis capabilities, including those for revenue forecasting and estimation in Kazakstan, are relatively limited at both the central and subnational government

[4] Some *rayons* may be too small to support their own units and could, therefore, use the analytical resources of the *oblast*.

[5] This system, which exists in the US has been proposed for Russia (Bahl et al. 1993).

[6] For more information regarding the budgeting process, see Chapter 6.

levels. MOF is responsible for developing the revenue forecasts for the Government of Kazakstan. The forecast period is one to two years in Kazakstan, while it is typically four to ten years in many other countries. Other types of revenue estimation and fiscal analysis, including estimation of the implications of changes in revenue-sharing arrangements, are virtually nonexistent at all levels of government. As noted earlier, this is due in large part to the historical lack of need for such analysis. This situation has resulted in a lack of machine readable data, the computers and software, and the well-trained and experienced analysts that are needed to provide fiscal analyses of the types described above. The inadequacies in the areas of computerization and software can be handled relatively easily if the necessary resources are made available. Data and database development are more problematic, but are not insurmountable problems. Training needs can also be satisfied, but this will take more time. Training should be aimed at management-level officials, as well as analyst-level positions, and must include training in model use and development, as well as the theory and practice of public finance in transitional economies.

The next two sections of this chapter discuss the current state of revenue forecasting and estimation at the central and subnational levels in Kazakstan.[7] Other types of fiscal analysis do not appear to exist at any level of government in Kazakstan. The discussion of the *oblast*-level methodology is based on field trips to the Taldykorgan and Almaty *oblasts*. While the methods used by these regions may not be representative of all regions in the country, many of the problems with data, computers, and analytical skills are likely to exist in most regions.

REVENUE FORECASTING AND ESTIMATION: CENTRAL GOVERNMENT'S CURRENT PRACTICES

Neither revenue forecasting nor revenue estimation has received much attention at the central government level in Kazakstan, despite a critical need for such analysis. Under the socialist regime, revenue forecasting was a straightforward calculation of taxes paid on the planned levels of output and wages. There was no expectation that enterprises would respond to economic downturns

[7] STC does not appear to play a role in any type of fiscal analysis, including revenue forecasting and estimation. This chapter, therefore, concentrates on the methods used in MOF and the finance departments of subnational governments.

through layoffs, or indeed that production levels would be significantly different from the planned levels of production. The tax system was not seen as a means to induce different behavior, for example, in production or employment.

In a market economy, however, revenue collections and liabilities are subject to forces of the market. During economic upturns, revenues generally increase, while during downturns, layoffs occur and production and revenue fall. Taxation can alter behavior and, therefore, output and wages. These behavioral impacts can significantly alter projected revenues as well as expenditures.

Currently, the revenue-forecasting component of the budget process is slightly more advanced than is revenue estimation, but in neither case have clear and sophisticated methodologies been developed and implemented.

Revenue Forecasting

The Revenue Forecasting Department of MOF is responsible for forecasting revenues for both the central government and the *oblast* governments. The forecasts are used in determining the sharing rates for the major revenue sources. The department is charged with producing a one-year forecast for all types of revenue. In formulating its revenue forecasts, the department collects information from a variety of other offices, some within MOF (the Budget Department, for example), and from other ministries (such as Transportation and Economics). By all accounts the revenue-forecasting method used by MOF is very aggregated in that few details on tax bases are developed. This leaves the department with little ability to take account of changes in the tax code.

The basic forecasting methodology used by MOF is relatively simple and straightforward. Baseline projections for the total amount of each type of tax are determined by assuming an unchanged ratio of the previous year's revenue to GDP.[8] Thus, revenues for the previous year are increased by the growth in real GDP and an inflation adjustment.[9] The Budget Department and

[8] This information was taken from interviews with the Revenue Forecasting Department of MOF and representatives of the USAID technical advisors working in MOF.

[9] The baseline forecast is made for total revenue, by type of revenue. As explained later, this aggregate forecast is then split among the central government and the *oblasts*.

STC provide data on the previous year's tax revenues, and the Ministry of Economy (MOE) provides the GDP figures.[10] The forecasted growth in real GDP and the inflation adjustment factor used are received from NBK, although MOF has expressed an interest in deriving its own macroeconomic forecast.

According to the Revenue Forecasting Department, the methodology used by MOF is somewhat more sophisticated for certain types of revenue, such as revenue generated from the enterprise income tax. For example, enterprise income taxes are projected by individual sector, instead of taken together for all sectors. For each sector, the previous year's total revenue and costs, taken in aggregate, are "projected" using inflation adjustments provided by NBK and MOE. These adjustments may be different for each sector. Once the inflation adjustments are made, adjustments are also made for changes in the composition of GDP. This method provides a slightly more detailed forecast, in that it forecasts revenue by sector, but it is actually just a variant of the method presented above.

While the Revenue Forecasting Department is responsible for forecasting revenue by type for the *oblasts*, it lacks the *oblast*-level data needed to do a thorough job.[11] The method used to distribute the forecasted revenue among *oblasts* is again very simple. It assigns each *oblast* a share of each revenue source based on the percentage of the total revenue from that source collected in each *oblast* in the previous year. For example, if Almaty City accounted for 20 percent of VAT revenue in 1994, it is assigned 20 percent of the forecast VAT revenue for 1995. The central government's budget forecast is simply calculated by multiplying the overall forecast by the appropriate sharing rates, once the sharing rates of the taxes have been determined.

There are a number of problems with the current forecasting methodology. First, the method does not allow adjustments for changes in the tax code. Forecasting revenue from a new VAT scheme would be nearly impossible with the aggregate level data that are used in MOF. Secondly, the methodology does not allow MOF to incorporate sectoral shifts that may be occurring within *oblasts*, except through a lagged response. This is critical in Kazakstan, due to the

[10] The data from STC are not always used, due to questions about their timeliness and comparability.

[11] As noted in Chapter 7, forecasts of *oblast* revenue are of little relevance ex ante because sharing rates and subventions are adjusted so that total revenues equal target expenditures. However, to the extent that forecasts of *oblast* revenues are inaccurate, *oblasts* have more or less revenues than anticipated.

heavy use of shared revenues. For example, even if the level of imports continued to grow in Almaty in 1995, the forecast for Almaty only captures the importance of imports in 1994. Therefore, Almaty's forecast budget would include less revenue than it might actually receive. This makes it very difficult for the central government to establish meaningful sharing rates and grants, and it could increase the fiscal disparities among *oblasts*.[12]

Third, the forecasts are not computerized in a systematic fashion. Thus, time must be spent on menial tasks related to forecasting; this may lead to human error. The data needed to support even this relatively simple forecasting methodology are not readily available, and are also subject to error. For example, the data from STC do not distinguish between liabilities and collections, nor do they consider the difference between current tax payments, arrears, and penalties. MOF must rely on its own budgetary information to project revenue. Most data that are available in different ministries or NBK are not available in computer-readable form. This again adds time and the risk of error to the forecasting process.

In summary, the revenue-forecasting methodology of the central government is highly aggregate and basically projects the preceding year's relationships between tax revenue and GDP. There is little ability to incorporate changes in the tax code or shifts in the economy into the revenue forecast. These shortcomings leave both the central and subnational governments of Kazakstan with little analytical information regarding expected flows of revenue. Thus, recommendations for changes in expenditure assignment and budgeting cannot be supported by objective forecasts of the revenue consequences for such changes. Given Kazakstan's unequal distribution of economic activity across the country, the concentration of mineral wealth, and the uneven growth in personal income across the country, the shift to a surcharge-based system of the type proposed in Chapters 8-10 will significantly increase the need for grants. To analyze the effects of these changes on the central and subnational budgets will require significant investment in data and analytical techniques. Both MOF and the *oblast* financial departments may benefit from technical assistance for development of models and databases for purposes of revenue forecasting, as well as for the development of a fiscal analysis unit.

[12] The problem can be exacerbated if the tax bases are also adjusted, because little information is available on production and income by sector by *oblast*. Certain exemptions could effectively eliminate revenues in certain *oblasts* and result in increases in fiscal disparities among *oblasts*.

Revenue Estimation

If the problems associated with revenue forecasting in Kazakstan are difficult, those associated with revenue estimation are worse. There is no real capacity to produce revenue estimates needed to support and inform the tax and intergovernmental fiscal reform programs in the country. MOF does not produce official estimates of the revenue implications of tax reform proposals, although they did try to get "some idea" of the revenue impacts of the 1995 changes in the tax code. The subnational governments, therefore, did not receive advance warning of the implications of the tax reform.

The problems with revenue estimation are obvious. The most crucial problem is that few useful micro-level data sets are available for firms and individuals. Therefore, it is nearly impossible to estimate the impact of many of the changes in the tax code that have been introduced over the past two years. As it is likely that there will be future changes in the tax code, these problems will continue and actually become more pressing. The lack of *oblast*-level data prevents the development of the analysis needed to estimate the impacts of tax law and revenue-sharing changes on the *oblast* budgets. This hinders the ability of MOF to determine the effects of new revenue sharing and grant arrangements and prevents the subnational governments from obtaining an accurate forecast of revenues under such new systems.

During the most recent budget exercise, MOF utilized the help of a technical assistance team sponsored by the United States Agency for International Development (USAID) to estimate the impact of the 1995 tax reform on the 1995 budget. While no true model existed to estimate the impacts at the beginning of the fiscal year, MOF developed a spreadsheet model to track revenue, by type, on a monthly basis. This allowed them to make informed revenue estimates for each subsequent month.[13] Such tracking could also be done by *oblast*. MOF hopes that this experience will give them better information for future estimation.

Given the types of changes being made to the tax code, MOF cannot rely on past revenue patterns to project revenues in the future. There has to be a concerted effort to assemble data and to design methods to produce

[13] The model that was used basically plotted the amount of revenue received from each revenue source by month. Based on the monthly growth pattern of revenue, adjustments were made to the expected revenue, by type, for subsequent months, and yearly totals were automatically adjusted. By approximately mid-year, the revenue growth had stabilized and the revenues for the remainder of the year continued on a relatively stable growth path.

systematic and objective estimates. Some of this work is underway with the USAID project, and possible extensions are discussed in the last section of this chapter.

REVENUE FORECASTING AND ESTIMATION: SUBNATIONAL GOVERNMENTS' CURRENT PRACTICES

In some ways, the revenue forecasting and estimation methods used at the *oblast* level are more sophisticated than those used by the central government. From interviews with officials of Taldykorgan and Almaty *oblasts*, it appears that the other subnational governments do not use very different information or methods. In some cases, the *rayons* may rely very heavily on the information from the *oblast* government in developing their forecasts.

Revenue Forecasting

As discussed in Chapter 6, the *oblasts* develop their own revenue and expenditure forecasts for their budgets. It is the responsibility of the *oblast* finance departments to produce these forecasts for the *oblast*, as well as the *rayons* that are subordinate to the *oblast*.

At the *oblast* level, revenues are forecast by type of revenue. In the cases of individual income tax and subnational government revenue sources (those revenues assigned purely to the subnational government), a simple extrapolation method is used to forecast revenue. The previous year's tax collections by type are extrapolated using the forecast of the growth in GDP and wages and/or inflation, much as is done at the central government level. Because GDP and wage forecasts are provided by MOF, they are not specific to an *oblast*; thus, this method is somewhat ad hoc for any particular *oblast*.

For enterprise income taxes, property taxes, and VAT, some enterprise-level data are used. The *oblasts* typically have relatively detailed information on most enterprises operating within their territory, which enterprises submit to the *oblasts*.[14] This information includes production costs, total revenue, taxes paid, number of employees, and so on. While these data are basically aggregated and projected using GDP and inflation growth rates, it appears that consideration is given to individual firms. For example, it may be known that a particular firm is expecting lower than average

[14] These data are not typically computerized, and incomplete reporting is typical. However, they represent a potentially rich data source for revenue forecasting and estimation.

growth of output, due either to past performance or to interviews with the finance department of the *oblast*. The revenue from this firm would then be extrapolated using a lower than average growth rate. Similar situations occur when a firm is expanding or growing faster than average. This information helps to tailor the forecast for the *oblasts* and the *rayons* within an *oblast*.

Although this methodology is somewhat ad hoc (these data are not available for all firms, there is no consistent methodology, and the projections for a particular firm may not be well founded), it likely results in a more accurate forecast for a particular *oblast* than the forecast developed by MOF. One of the main problems with forecasting at the subnational level is the dearth of computer resources available for the analysts in the finance departments. The enterprise data just mentioned are not machine readable. The budget data that the finance department must work with are also not machine readable. With relatively little investment, these firm-level data could be computerized and exploited to develop more objective, timely revenue forecasts. Using firm-level data where possible, the *oblasts* could develop a database by industrial sector similar to that used in microsimulation modeling. This is discussed in more detail in the last section.

Revenue Estimation

Ironically, although *oblasts* have a good data source from which to develop revenue estimates, it appears that such estimates are rarely made. When the *oblast* finance officials were asked about their revenue estimates for the recent tax law changes, the overwhelming response was that none was made. At the *oblast* level, it seems necessary to demonstrate the need for revenue estimating as well as the methods that can be used. The *oblast* finance departments do not see the need to understand the implications of tax law changes at the central level, although the impacts on *oblasts* are obviously significant, and may be very different among *oblasts*.[15] Also, the recommendations contained in Chapters 7-10 regarding new tax-sharing arrangements and grants will have significant impacts on all of the subnational governments —impacts that could make or break a reform.

[15] This reaction is consistent with the overall process of budgeting in Kazakstan (see Chapter 6). Because the subnational governments feel that they have little room to negotiate their shared revenues with the central government, they do not see a need to develop analysis capabilities under the current structure of intergovernmental relations.

INPUTS TO THE DEVELOPMENT OF QUANTITATIVE FISCAL ANALYSIS CAPABILITY

Given the state of fiscal analysis in Kazakstan and the number of changes that the country has experienced in its tax law, as well as those proposed in this report for intergovernmental relations, the country could benefit from the development of capabilities for quantitative fiscal analysis at all levels of government. A number of "inputs" are needed for the development of such capabilities. First, a fiscal analysis unit consisting of a highly skilled, well-equipped group of professional analysts provides the backbone for the quantitative fiscal analysis needed in Kazakstan. Such units should exist in both MOF and the *oblast* administrations, for reasons discussed above.

A tax analysis unit already exists in STC. It is comprised of persons who played a key role in developing the new tax code. As long as STC remains part of MOF, there appears to be no compelling reason to move the existing unit from STC to MOF proper. Because of its close working relationship with both STC and MOF, the unit can draw on both STC and MOF expertise, as needed. It appears that the primary weakness of this unit is its inability to do sophisticated quantitative analysis, due in part to the lack of adequate data, equipment, and training. If STC were to become separate, it would presumably be appropriate to move the fiscal analysis unit to MOF, as it provides analytical support for the formulation of policy.

A fiscal analysis unit would be responsible for the following:[16]

- development of revenue forecasts;
- estimations and analyses of the impacts of changes in tax laws, grant policies, and tax-sharing arrangements;
- analyses of the effects of fiscal policy changes on individual and firm behavior, such as savings, investment, and job growth, as well as on the general economy;
- analyses of the effects of changes in the economy on the governments' budgets; and
- advice on the development of new fiscal policies.

[16] The central government's fiscal analysis unit should analyze these impacts on central as well as subnational governments, whereas the subnational government units would concentrate on the impacts on subnational governments.

Members of the fiscal analysis unit(s) would include (i) economists with specialties in applied macroeconomics and microeconomics and public finance; (ii) tax lawyers to assist in the development and interpretation of tax law; and (iii) tax administrators to assist in implementation, including design of forms, instructions, payment and collection procedures, and the analysis of compliance behavior.

Additionally, most of the quantitative analyses that need to be done require the use of computers and computer-readable data. Adequate forecasting models can be built from aggregate historical data on tax bases and macroeconomic variables, including total output by sector, wages, price levels, exchange rates, and unemployment.[17] Similar models can be used for some revenue estimation, but microsimulation models are the choice of most policymakers for revenue estimation. Microsimulation models require data on individuals or firms that are typically available from tax records, accounting records, and household surveys.

The computer hardware and software requirements for either type of model are minimal in most countries. One of the most important requirements, however, is a staff of well-trained and experienced policy analysts. The development, maintenance, and use of these models require training in the use of computers, knowledge of the data, experience in incorporating policy alternatives, and a background for analyzing the output of the models. It is not sufficient for an analyst simply to read results from these models. Training in the area of public finance relevant to the country (market-oriented, planned, or transitional) is necessary for analysts to determine the format and relevance of their output. Policymakers themselves should be thoroughly trained in the area of market-based public finance so that they can interpret information regarding the impact of various tax law changes. These policymakers should also be trained in the basics of revenue forecasting and revenue estimation models so that they can understand their importance and use.

MODELS FOR REVENUE FORECASTING AND ESTIMATION: RECOMMENDATIONS

Three types of quantitative models are recommended for revenue forecasting and estimation in Kazakstan. The first is a

[17] The exact structure of these models is not discussed here. For more information, see Bahl (1972) or HIID (1994).

relatively simple spreadsheet model that allows the central and *oblast* governments to analyze the effects of relatively gross policy changes, for example, in tax-sharing rates and tax assignment.[18] This type of model can be used in the short term by both central and subnational government analysts, pending development of data needed for more sophisticated models. Then it may serve as a backup model that can be run quickly to analyze changes in intergovernmental policies. This model is less useful for analyzing major changes to the tax code. The second type of model is an aggregate regression model that is specifically aimed at using data and resources that are available in Kazakstan to forecast revenues. This aggregate model should be developed in the Revenue Forecasting Department of MOF, and shared with the *oblast* government finance departments. In the long run, it can be a backup model for the third type—microsimulation modeling, which requires database development.

Spreadsheet Models

The format of spreadsheet models is largely determined by the data available and the types of policies that an analyst wishes to examine. In Kazakstan, among the pieces of data that are available and useful for policy analysis are the budgets of the central government and *oblasts*, disaggregated by expenditure and revenue category and by *oblast*. Demographic data on income and population by *oblast* can be easily added to such a model, and much of these data are currently available. An enormous amount of insight regarding potential fiscal disparities and effects of various changes in the tax-sharing and grant system can be gleaned from these combined data.

A simple example is presented in Tables 4.1 and 4.2 to illustrate the type of analysis that is possible with such a model. (This example is not necessarily a recommended change.) In Table 4.1, the current revenue collections and sharing rates are presented by *oblast* for 1995. One of the changes that might be analyzed is a change in the sharing rates to move toward a more uniform system. The "proposed law" in Table 4.1 assumes the following uniform sharing rates: 100 percent of the individual income tax, none of VAT, 100 percent of excises, and 50 percent of the enterprise income tax. What is the effect of these changes? Retained revenues under the new sharing

[18] This model would be most useful for changes in tax assignments for pre-existing taxes. Analysis of new taxes and their assignment among levels of government would require more detailed models and the development of new data.

Table 4.1: Tax Collections, Sharing Rates, and *Oblast* Revenues, for Major Taxes, 1995 (Hypothetical Oblast Sharing Rates: Individual Income Tax and Excises, 100%; Enterprise Income Tax, 50%; VAT, zero)

(tenge million)

	Individual Income Tax	Enterprise Income Tax					Value-added Tax				
Oblast	1	2	3	4	5	6	2	3	4	5	6
Akmola	923.0	1,824.4	90.0	1,642.0	50.0	912.2	2,133.7	50.0	1,066.9	0	0
Aktubinsk	1,369.1	1,653.3	51.3	848.2	50.0	826.7	1,791.3	50.0	895.7	0	0
Almaty	650.8	429.8	100.0	429.8	50.0	214.9	374.0	50.0	374.0	0	0
Atyrau	1,057.1	1,160.1	39.5	458.2	50.0	580.0	1,126.6	100.0	112.7	0	0
East Kazakstan	1,461.3	1,115.8	100.0	1,115.8	50.0	557.9	1,137.1	10.0	1,137.1	0	0
Jambyl	549.6	487.0	100.0	487.0	50.0	243.5	480.2	100.0	480.2	0	0
Jezkazgan	1,327.7	263.4	100.0	263.4	50.0	131.7	616.4	100.0	616.4	0	0
West Kazakstan	751.5	640.2	100.0	640.2	50.0	320.1	628.8	100.0	628.8	0	0
Karaganda	2,574.6	1,878.5	54.0	1,014.4	50.0	939.3	3,058.3	100.0	1,529.2	0	0
Kzyl-Orda	348.9	370.8	100.0	370.8	50.0	185.4	322.6	50.0	322.6	0	0
Kokshetau	546.7	442.5	100.0	442.5	50.0	221.3	720.4	100.0	720.4	0	0
Kostanai	1,780.2	2,997.8	29.4	881.3	50.0	1,498.9	1,569.4	100.0	784.7	0	0
Mangystau	1,294.1	847.0	19.7	166.9	50.0	423.5	759.1	50.0	75.9	0	0
Pavlodar	2,081.9	2,152.0	26.2	563.8	50.0	1,076.0	1,567.5	100.0	313.5	0	0
North Kazakstan	578.9	271.9	100.0	271.9	50.0	136.0	536.8	10.0	536.8	0	0
Semipalatinsk	574.9	494.4	100.0	494.4	50.0	247.2	1,025.7	20.0	1,025.7	0	0
Taldykorgan	336.6	173.1	100.0	173.1	50.0	86.6	205.2	100.0	205.2	0	0
Torgai	249.3	128.0	100.0	128.0	50.0	64.0	208.1	100.0	208.1	0	0
South Kazakstan	960.5	1,878.8	100.0	1,878.8	50.0	939.4	1,478.4	100.0	1,478.4	0	0
Almaty City	2,983.3	5,166.3	8.9	459.8	50.0	2,583.2	6,266.3	100.0	1,253.3	0	0

Table 4.1 *continued*

Oblast	Excise Taxes 2	3	4	5	6	Industrial Workers	Average Wage	Payroll	Distribution (percent)	Population	National Distribution
Akmola	233.4	100.0	233.4	100.0	233.4	75.9	148.0	134,798.0		869.6	0.1
Aktubinsk	326.5	100.0	326.5	100.0	326.5	49.8	144.6	86,413.0	64.1	760.2	0.0
Almaty	36.2	100.0	36.2	100.0	36.2	29.9	138.6	49,730.0	57.6	962.9	0.0
Atyrau	1,145.7	10.0	114.6	100.0	1,145.7	22.0	184.6	48,734.0	98.0	457.7	0.0
East Kazakstan	573.2	100.0	573.2	100.0	573.2	106.5	147.5	188,505.0	386.8	961.0	0.1
Jambyl	334.5	100.0	334.5	100.0	334.5	56.6	117.6	79,874.0	42.4	1,052.6	0.0
Jezkazgan	41.8	100.0	41.8	100.0	41.8	52.6	254.2	160,451.0	200.9	493.4	0.0
West Kazakstan	276.8	100.0	276.8	100.0	276.8	37.0	134.7	59,807.0	37.3	674.3	0.0
Karaganda	248.1	100.0	248.1	100.0	248.1	177.0	211.3	448,801.0	750.4	1,305.5	0.1
Kzyl-Orda	80.2	100.0	80.2	100.0	80.2	23.4	100.9	28,333.0	6.3	606.3	0.0
Kokshetau	229.0	100.0	229.0	100.0	229.0	34.3	132.7	54,619.0	192.8	674.9	0.0
Kostanai	92.1	100.0	92.1	100.0	92.1	88.9	158.4	168,981.0	309.4	1,082.5	0.1
Mangystau	18.1	10.0	1.8	100.0	18.1	31.1	272.9	101,846.0	60.3	338.5	0.0
Pavlodar	388.1	50.0	194.1	100.0	194.1	97.4	274.0	320,251.0	314.5	965.9	0.1
North Kazakstan	330.8	100.0	330.8	100.0	330.8	46.0	123.8	68,338.0	21.3	620.6	0.0
Semipalatinsk	114.9	100.0	114.9	100.0	114.9	48.3	147.5	85,491.0	125.1	839.2	0.0
Taldykorgan	8.2	100.0	8.2	100.0	8.2	34.2	111.0	45,554.0	53.3	737.9	0.0
Torgai	24.5	100.0	24.5	100.0	24.5	12.6	177.6	26,853.0	59.0	313.2	0.0
South Kazakstan	1,148.6	100.0	1,148.6	100.0	1,148.6	87.9	103.6	109,277.0	406.9	1,969.2	0.1
Almaty City	314.3	20.0	1,571.5	100.0	1,571.5	83.6	178.4	178,971.0	163.8	1,185.4	0.0

1 Collections Current Law
2 Collections
3 Sharing Rate/ Current Law (percent)
4 *Oblast* Revenue/Current Law
5 Hypothetical Sharing Rate (percent)
6 Hypothetical *Oblast* Revenue

Sources: Yearbook of Kazakstan; USAID-Barents; and authors' compilations.

rules are presented as "hypothetical *oblast* revenue" under each tax.

The adjustment of sharing rates is likely to be an iterative trial and error process in the short run, as policymakers consider the impact these changes have on each *oblast*. Table 4.2 shows the percent change in retained revenue from the hypothetical revenue sharing proposal. This summarized information allows

Table 4.2 Change in the Distribution of Revenue From Hypothetical Revenue-Sharing System (Hypothetical *Oblast*-Sharing Rates: Individual Income Tax and Excises, 100% Enterprise Income Tax, 50%; VAT, 0%)
(tenge)

Oblast	*Oblast* Revenue (Current Law)	*Oblast* Revenue (Hypothetical)	Percent Change
Akmola	3,865,271	2,068,643	-46.48
Aktubinsk	3,439,388	2,522,245	-26.67
Almaty	1,490,800	901,900	-39.50
Atyrau	1,742,554	2,782,835	59.70
East Kazakstan	4,287,320	2,592,360	-39.53
Jambyl	1,851,300	1,127,600	-39.09
Jezkazgan	2,249,333	1,501,217	-33.26
West Kazakstan	2,297,280	1,348,420	-41.30
Karaganda	5,366,261	3,761,969	-29.90
Kzyl-Orda	1,122,520	614,480	-45.26
Kokshetau	1,938,560	996,910	-48.57
Kostanai	3,538,343	3,371,183	-4.72
Mangystau	1,538,668	1,735,677	12.80
Pavlodar	3,153,277	3,546,007	12.45
North Kazakstan	1,718,420	1,045,670	-39.15
Semipalatinsk	2,209,880	936,980	-57.60
Taldykorgan	723,140	431,390	-40.34
Torgai	609,900	337,800	-44.61
South Kazakstan	5,466,260	3,048,460	-44.23
Almaty City	5,010,655	7,137,923	42.45

Source: Data provided by USAID-Barents.

policymakers to determine whether they should try re-adjusting the sharing rates, or match the changes in revenues with new levels of subventions. The combinations of new sharing rates are almost limitless, yet this relatively simple model can inform policymakers how *oblasts* are affected by such changes. Surcharge arrangements can be analyzed with this model by applying additional rates to those used for the base case or by splitting revenues from the rates

assumed in the base case.[19] New forms of revenue sharing such as the grants systems discussed in Chapter 9 can also be analyzed with this model. Depending on the type of grant, the information on revenue collections, population, or income could serve as a means to distribute the general revenue of the government. This model provides the necessary data by *oblast* to determine the impacts of new grants by *oblast*.

Aggregate Regression Models

To forecast revenues, it is necessary to know how revenues are related to macroeconomic variables and how the latter are expected to change in the future. Analysts can forecast the base of specific taxes by major sector, and apply alternative tax treatments to these bases to forecast revenues; for example, different tax rates and exemptions for certain sectors could be used. The central component of the aggregate regression forecasting model is a system of equations designed to explain the relationship over time between the bases of the four major taxes (VAT, enterprise income, individual income, and excise) and a number of macroeconomic variables (GDP, price indices, and employment). The relationships between the tax bases in a given period and the macroeconomic variables are estimated using either ordinary least-squares or some type of simultaneous equations estimator, any of which controls for the time series nature of the data.[20]

The forecasts of the macroeconomic variables used to forecast revenues should be coordinated with MOE and NBK to take full advantage of the work that is underway in NBK to upgrade the macroeconomic forecasting capabilities of the government.[21]

The system of equations used for this model should be as disaggregated as possible, for example, by industrial sector for VAT, enterprise income, and excise tax, and by *oblast* if possible. For the individual income tax, a projection of the overall wage bill is sufficient for

[19] Some of these intergovernmental fiscal reforms are discussed in Chapters 7-10. The surcharge recommendations assume that the central government tax rates would be reduced to make room for the subnational governments' surcharges. In this case, there is little reason to expect that taxpayer compliance would be altered.

[20] Some models use other types of estimation including simple moving average techniques, various lagged models, and autoregressive-moving average processes.

[21] This is a USAID-sponsored project to redesign the macroeconomic forecasting capabilities of NBK. MOF would also like its own macroeconomic model, for which it may receive USAID assistance.

forecasting individual income tax revenue. If possible, there should be some disaggregation between the self-employed and all others.

One of the major complaints about such a model in transitional countries is that little historical data are available from which to estimate the system of equations. This is somewhat of a problem, but it is not a critical one. In many cases, quarterly or even monthly data can be used to estimate the relationships between tax bases and the macroeconomic variables. Also, some of these basic relationships tend to be relatively stable, which may allow simpler estimation of the relationships. In any case, holes in the data may have to be filled with judgment regarding the relationships between the bases and the macroeconomic variables; the method is, therefore, somewhat subjective, as many forecasts are. This type of aggregate model can also be utilized by the subnational levels of government, in particular, by the *oblasts*. The fact that data collection activities are largely concentrated at the *oblast* level should encourage sharing of data and basic methodologies at the central and *oblast* levels of government.

Currently, USAID is sponsoring work in revenue forecasting at MOF in Kazakstan. The work is being carried out by the Barents Group. While the details of this technical assistance program are currently being developed, the basic approach appears to be this type of aggregate forecasting model. The model can also be used for some revenue estimation problems, but it is not well suited to estimating detailed changes in the tax code because of the inputs of the model; data at the sector level do not afford the opportunity to estimate the detailed impact of changes in particular credits, deductions, or exemptions, which may influence particular taxpayers and industries within a sector differently.

In summary, the aggregate regression model does provide some quantitative basis for revenue forecasting, and somewhat less for revenue estimating. It should be viewed as an intermediate step toward the development of more sophisticated analytical capabilities within MOF and the finance departments of the subnational governments.

Microsimulation Models

The third type of modeling, microsimulation modeling, should be viewed as a long-term goal of MOF. Microsimulation models are tools of revenue forecasting, estimation, and fiscal analysis that are based on microdata from individuals or enterprises. They allow the analysts to estimate the effects of changes in the tax code on overall levels

of revenue, as well as by various groups of taxpayers. Using such a model, revenue forecasting can compare "current law," using the tax structure and revenue-sharing arrangements in place in the current year, and "proposed law," using a tax structure that is under consideration, but not yet approved. These models combine information on taxpayers (firms or individuals) with computer programs that "simulate" or calculate tax liability for each member of the taxpayer sample. A system of weights is applied, so that the sample is representative of the entire taxpaying population. These models are easy to adapt to alternative tax and revenue-sharing schemes, and thus provide much more flexibility for revenue estimation purposes than do aggregate models.[22]

Microsimulation models enable analysts to calculate the effects of changes in the tax law and tax assignments on tax liabilities, tax burdens, and tax payments, using individual-level observations of behavior of firms and individuals. Therefore, these models can be used to analyze the impacts of tax and intergovernmental fiscal policy on the central and subnational governments. For forecasting purposes, this type of model allows the analyst to examine what happens to the distribution of revenue and tax burden over time. In this way, the microsimulation model gives analysts and government policymakers more detailed information regarding the effects of tax policy on individuals and businesses. Microsimulation models are used worldwide as tools of fiscal analysis (see Box 4.1).

Microsimulation models are comprised of three pieces: (i) a micro-level database, typically information from tax returns for individuals or enterprises for the base year; (ii) a tax calculator that is a computer program that calculates the tax paid under alternative tax structures and revenue-sharing, revenue assignment schemes; and (iii) an output program that categorizes taxes paid by income group, tax burdens, "winners and losers," and the overall change in revenue.

The data needed for the model should come from a sample of taxpayers—individuals or enterprises—and contain all available and relevant information from the tax returns.[23] A representative sample should be designed for each tax: VAT, enterprise income, individual income, and excise. In the US, for example, a 0.1 percent stratified random sample is drawn from approximately 112 million individual income tax

[22] For more information on these models, see Bahl, Hawkins, Moore, and Sjoquist (1993), and US Department of Treasury (1990).

[23] Alternatively, micro-level data may be obtained from accounting information on enterprises in the case of Kazakstan. These data are collected by the statistical department.

Box 4.1. Worldwide Experiences with Microsimulation Models

A number of countries have long used microsimulation models as tools of fiscal analysis. In the US, the Department of Treasury uses two microsimulation models, one for the individual income tax (with approximately 110,000 observations) and one for the corporate income tax (with approximately 50,000 observations). These models are among the most sophisticated in the world, and are used for both revenue estimation and revenue forecasting. The tax data in the individual model are linked to data sets containing both expenditure and demographic information obtained from the Department of Commerce.

A microsimulation model was developed for Jamaica during the 1983-1986 tax reform. This model was developed for the individual income tax and contained micro-level information for approximately 45,000 taxpaying employees. The model was used extensively in the tax reform debate and provided the analysis necessary to draft legislation that provided for a number of changes to the tax base and rate in Jamaica (Bahl, 1991).

The city of Moscow is currently developing a microsimulation model for VAT and the enterprise income tax. This modeling activity, sponsored by USAID, is being undertaken with the technical assistance of the Policy Research Center of Georgia State University in the US. The model will be used by the city to analyze the impacts of central government changes in the tax rates and base, as well as to simulate hypothetical city-supplied reforms. The database for both models consists of information from both tax returns and firm balance sheets. A stratified random sample of these data files will be taken to develop the database for the microsimulation model. This is one of the first examples of a true microsimulation model in a transitional country.

returns (US Department of Treasury, 1990). For each observation in the data set, all relevant information from the tax return is entered into the computer. Population weights are assigned to each observation so that the weighted observations will equal the actual population totals from which the sample was drawn.

Additional data may be imputed to each observation. For example, it may be useful to impute the consumption patterns of the taxpayers as well as their individual income tax liability. This would allow analysis of the effects of changes in consumption-based taxes, as well as direct taxes, on individual taxpayers. These data do not currently exist in Kazakstan and the development of

such data will not occur quickly, due to the need to redesign population-based surveys in the country. This should be a longer term goal of the Government of Kazakstan.[24]

The base year micro-level data will always be based on some past year, due to data availability. The data, therefore, need to be "aged" or extrapolated into the future, to allow for projections of baseline revenues or forecasted estimates of changes in the tax code. One of the most straightforward ways to age the data is to separate major income or output categories, and make separate projections of each of those groups based on past performance, macroeconomic indicators produced by MOE and NBK or in the private sector, and regression analysis. Time series regressions can be used to estimate the relationships between the income or output base and the macroeconomic variables. The coefficients of the regressions could then be used with the official macroeconomic forecasts of these variables to project the new level of income and output by sector.[25]

The tax calculator is a straightforward computer program that calculates the actual tax liability for each individual observation in the data set. In the case of each type of tax, the computer program is basically a series of statements reflecting the calculations that taxpayers (individuals or firms) actually make when computing their tax liability. By changing parts of the tax calculator to reflect changes in the law, the program can simulate new tax liabilities for any number of proposals. New tax surcharge arrangements would be reflected in the calculator.

The tax calculator also assigns taxes to economic groups and then to income groups, based on various tax incidence assumptions. For example, if the burden of the enterprise income tax was assumed to fall 50 percent on labor and 50 percent on capital, the program could allocate tax changes in accordance with these incidence assumptions, which could also be easily changed. Excise and VAT liabilities can be imputed to the individual and enterprise records as well. The tax calculator program can be written using any number of relatively inexpensive software programs including C++ and Delphi, two PC-based software programs.

Finally, the output of this model is extensive. Generally, output includes the following tabulations by income group or industry sector: the distribution of tax burdens under current law and proposed law, the "winners" (those with reduced tax liability), and the "losers" (those with increased tax liability). Summary output typically includes (i) total revenue impacts; (ii) a forecast of

[24] In the event such data were developed, direct imputation or regression analysis could be used to impute these additional data.

[25] Some models use simpler aging techniques, for example, specification of alternative growth scenarios.

revenue and revenue changes; and (iii) summary statistics by income or industry group. Finally, tax liability by *oblast* could also be included in the output program, which would provide information on the effects of changes in central government taxes on collections by *oblast*.

A second output program would then allocate retained revenue by *oblast* using revenue-sharing rates and tax assignment rules. This output program could be adjusted for new sharing and assignment rules. The final output would then contain both a distribution of tax burden by *oblast* and a tool to estimate revenues by *oblast*. In most cases, the output program is written in the same computer language as that of the tax calculator.

The data needs for this type of model are relatively extensive, but such data may currently exist in some form. A program of database development and investment by the government could benefit the central and subnational governments substantially by increasing their fiscal analysis capacities. The data needed are as follows:

- tax data (or related accounting information): samples of taxpayers by type of tax, stratified by size of firm, type of income, sales, and industry. These data should be in complete files, meaning that they should be computer-readable data files containing most information on the tax returns without names, addresses (except for *oblast* identification), and identification numbers to preserve confidentiality. The annual microdata files should be used to provide summary information on tax filers, income, deductions, and so on. Historical files should be maintained. Detailed quarterly data should be made available regarding tax collections by type of tax, with a breakdown by type of income and sector;
- socioeconomic and demographic data: survey data on family expenditures and household composition. These should be made available on a timely basis;
- national aggregates: for example, GDP, prices, employment by sector, wages, and total income, on a quarterly and monthly basis. MOF should maintain its own database, where possible;
- hardware needs for microsimulation. Hardware needs are relatively modest. Most of the data for the model and the programs can be run on 486 PCs with math coprocessors (or, of course, PCs with Pentium chips). One machine should be dedicated to a model for each tax, and the hard

disks should be large enough to hold complete data files; and

- training in the area of fiscal analysis in market-based economies. This should parallel the development of any forecasting and estimation model. The training should be geared toward providing analysts with hands-on experience understanding the questions and issues raised by altering tax structures in an economy driven by the market. Without training, the development of revenue forecasting and estimation capabilities are truly handicapped.

There are a number of scenarios for effective training in the area of forecasting and estimation. The analyst-level training should include course work and lectures in the area of public finance in transitional market economies. This level of training is aimed at developing the analysts' understanding of the impacts of changes in the tax system on individual and firm behavior so that they learn what to ask of their models. The second type of training should include courses in specific areas of fiscal analysis, such as revenue forecasting and estimation techniques, the development of microsimulation models, and database development. Both types of training could be offered to central and subnational government officials so that both levels of government could benefit from the training to better their ability to undertake long-term fiscal management.