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THE DESIGN OF EQUALIZATION GRANTS: THEORY AND APPLICATIONS

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**PART TWO
SIMULATING THE ALLOCATION OF
INTERGOVERNMENTAL FISCAL TRANSFERS**

SUMMARY

This second part of this module on the design of equalization grants applies the theoretical concepts (set out in part one of this module) by developing an analytical model that simulates the allocation of intergovernmental fiscal transfers. For this purpose, this documentation is accompanied by a diskette containing the *Intergovernmental Fiscal Transfer Simulation Model*. Alternatively, the simulation model may be downloaded from the internet.

The accompanying model allows the user to simulate changes in the system of intergovernmental fiscal relations for a fictional country, the Republic of Florin, and analyzes the impact of alternative intergovernmental transfer mechanisms on the allocation of public resources. The purpose of this exercise is to provide a step-by-step demonstration of (a) how such a simulation model could be developed, and (b) how a simulation model can provide a unified analytical framework for reforms in intergovernmental relations.

The module *The Design of Equalization Grants: Theory and Applications* was developed for the World Bank Institute by Jorge Martinez-Vazquez and Jameson Boex at the Andrew Young School of Policy Studies, Georgia State University.

SECTION 1

INTRODUCTION

Let's presume that you, the reader, have been hired as the Lead Consultant for the Fiscal Decentralization Project in the fictional Republic of Florin. In this position, you are asked by the Government of Florin (GoF) to design and recommend an equalization transfer mechanism for Florin. In addition, in order to guide their policy decisions, the GoF further asks you to develop a simple spreadsheet module that will allow policy makers to "try out" and simulate a wide array of formulas for the new Equalization Fund.

The remaining sections of this document discuss the steps that would be involved in the development of an intergovernmental transfer simulation model for the Republic of Florin. Through the development of the model, we also seek to demonstrate how a simulation model can provide a unified analytical framework for reforms in intergovernmental relations.

Naturally, the first step in your consultancy would be to acquaint yourself with the decentralization policy of the Government of Florin. The remainder of this introduction will provide a brief background on Florin, the fictional subject of our study.

The Republic of Florin

Florin is located on the northeast coast of the (also fictional) continent of South Afrasia. As a former colony of the Kingdom of Gulden, Florin was historically governed in a highly centralized manner. This highly centralized arrangement was perpetuated in the years following Florin's transition to independence in 1975. The post-independence period has

been characterized by economic stagnation and decline, political instability and a series of consecutive military regimes.

Since the colonial era, District Commissioners have been appointed to handle some minor local affairs, such as waste collection and minor community programs, but all other government programs were, and continue to be, implemented at the central government level. Local governments have not been given any independent sources of revenue, so that the only resource available to Florin's district governments are small transfers negotiated between the Ministry of Local Governments and the fourteen District Commissioners. Main economic and fiscal indicators for Florin (again, fictitious) are reported in Box 1.

BOX 1	
REPUBLIC OF FLORIN	
Population:	19.6 million
Land Area:	1.76 million square kilometers
Population Density:	11.1 persons per square kilometer
Number of Districts:	14 districts
Currency:	Florin Dollars (FL\$)
Exchange Rate:	US\$ 1 = FL\$ 4.83
Gross Domestic Product:	FL\$ 110.2 bln. (FL\$ 5608 per capita)
Government Revenues:	FL\$ 21.37 bln. (19.40 % of GDP)
Government Expenditures:	FL\$ 20.99 bln. (19.05 % of GDP)

In contrast to Florin's tradition of highly centralized governance, the recently elected

President and Parliament of Florin wish to pursue a strategy of decentralization in order to improve the efficiency and equity with which government services are provided. Florin recently held local government elections, replacing the appointed District Commissioners with elected District Councils. The recently adopted Local Government Act assigns the responsibility for a number of government functions to the new District Councils, including local government administration, primary and secondary education, community development, maintenance of local roads, fire prevention, and a number of other minor functions typically assigned to local governments.

In light of the redefined role of local governments, the Local Government Act has further assigned the revenues from the property tax to the local government level. In addition, the Act contains clauses that require the establishment of an Education Fund, a Community Development Fund and an Equalization Fund to ensure the adequate funding of local governments. The *Intergovernmental Fiscal Transfer Simulation Model* is envisioned as a critical analysis tool to assist the government in the design of its system of intergovernmental transfers and in the selection of a formula for its Equalization Fund.

SECTION 2

DATA AND MODEL STRUCTURE

As you contemplate your task of developing the simulation model, you decide that a spreadsheet program will provide the appropriate platform to develop this model, for a number of reasons:¹

- Since the model will be circulated widely among government officials in Florin, the model should be developed in a user-friendly format that should be accessible to anyone with minimal exposure to computers.
- The software used should provide a flexible environment, allowing the model's user to change policy parameters without altering programming code.
- You want the program to be as transparent as possible, so that every user can observe and track each step in the policy formulation process that the model simulates.

After careful consideration, you arrive at the following plan of action regarding the main components of the model:

- First, you will need to collect relevant data on all local governments in Florin. You decide to gather all necessary data and enter it into a worksheet named "DATA"
- Second, you are informed by the Minister of Local Government that consensus has

¹ The *Intergovernmental Fiscal Transfer Simulation Model* is programmed in Microsoft Excel (version 6 and later). The file takes up approximately 70 KB of disk space and should run on virtually any personal computer. Microsoft Excel provides a user-friendly and flexible environment for the model. It is recommended that the model is run from the hard drive for improved performance.

already been reached that all transfers should be allocated using a formula-based approach. For example, agreement has been reached with the Ministry of Education that the Education Fund will be allocated between the districts in proportion to the number of school-aged children in each district. These “allocation factors” that are to be used for the formula will be computed in a second worksheet, “FACTORS.”

- Third, the GoF is faced with two sets of policy decisions in the design of the system of intergovernmental transfers. First, the government will need to decide how much funding to allocate towards the Education Fund, Community Development Fund, and the Equalization Fund. These funding levels, together with the own revenues assigned to local governments, will determine the vertical fiscal balance in the system of intergovernmental fiscal relations. Second, the government will have to determine the allocation factors that will be used in the distribution of the Equalization Fund. This will determine the horizontal fiscal balance in the system. The model’s user will be able to select these policy options in the worksheet “POLICY.”
- Fourth, based on the data for Florin’s districts; the allocations factors that were computed; and the policy choices selected regarding funding levels and the equalization formula, the model should simulate the level of transfers that each district would receive . This is done in the worksheet “SIM.”
- Finally, you know that the GoF is concerned about achieving both vertical and horizontal balance in the new system of intergovernmental relations. The model should therefore include a number of analytical tables in a worksheet called “ANALYSIS.” Thus, the model instantaneously computes a policy scenario

based on the policy options selected by the user, determines the impact of the simulated scenario on individual district budgets, and analyzes the impact of the policy choices on the vertical and horizontal balance of the system of intergovernmental relations.

In order to facilitate use of the model, we can take advantage of a number of factors of the spreadsheet program:

- Data fields are color-coded. Policy variables that can be selected by the model's user are indicated in bright yellow. Variables that directly depend on the user's selection are indicated in light green. Relevant policy parameters that have already been determined by the GoF (and thus cannot be changed by the model's user) are contained in light red cells.
- All policy choices that require user input are contained in the worksheet "POLICY." The model's user may further experiment with additional allocation factors in the worksheet "FACTORS."
- The areas that do not require user input are "protected" to prevent accidental changes in the spreadsheet model's programming.²
- Attempts were made to keep the structure of the model as transparent as possible. This allows the user to see each step of the simulation process and also allows for future modifications of the programming in the model.

² Each worksheet can easily be "unprotected" by clicking on "Tools\Protection\Unprotect Sheet" (no password was used). This would allow more advanced users to make modifications to the model.

Data

The fiscal data used for the simulation model (contained in the DATA worksheet) were obtained from both published and unpublished reports by the Florin Ministry of Finance and the Ministry of Local Government. Fiscal data represent budget execution amounts. In addition, data on local economic and social characteristics were obtained from the Florin Statistical Bureau for the same year. Figure 1 shows part of the DATA worksheet as it would appear on the computer screen.

FIGURE 1
THE DATA WORKSHEET

ECONOMIC, SOCIAL AND FISCAL DATA SHEET										
Intragovernmental Fiscal Transfers Simulation Model										
Demographic, Economic and Social Data										
	Population	Pop. 65+0	Population 6-17	Population 65+	Regional Fiscal Rev.	Gross Reg. & Econ. Rev.	Population (1000s)	Land Area (1000km ²)	Fiscal Dev.	
1	1	700,796	40,000	111,277	147,139	87.2	4,452.6	187,375	172.4	1.0
2	2	1,135,328	83,304	208,680	197,412	94.7	11,448.7	777,592	475.0	1.57
3	3	1,473,076	98,367	246,478	219,239	100.9	11,771.5	1,152,252	270.7	1.1
4	4	1,450,032	100,948	191,022	283,719	83.7	9,461.8	273,351	145.7	1.1
5	5	1,398,880	63,071	177,888	173,245	73.0	8,072.0	794,437	144.0	0.7
6	6	477,774	3,878	8,047	3,473	33.6	904.1	12,393	170.7	0.3
7	7	1,338,300	117,677	226,873	313,271	100.8	11,111.1	915,521	160.0	1.1
8	8	747,109	44,705	111,401	177,755	106.4	3,977.8	183,373	55.3	1.1
9	9	337,789	45,096	128,888	173,753	87.7	3,077.8	384,717	85.3	0.7
10	10	4,758,746	290,446	678,440	1,112,373	103.9	32,225.1	5,117,434	1,111.0	1.1
11	11	1,470,050	15,741	240,115	363,337	103.8	5,624.8	887,333	31.9	1.1
12	12	1,339,492	80,786	241,070	383,371	80.8	6,781.7	487,418	70.0	0.7
13	13	1,253,837	57,746	187,688	119,532	101.9	4,272.1	425,372	27.0	1.0
14	14	352,888	67,000	111,027	177,377	111.0	3,888.8	317,333	15.7	1.0
15	15	13,343,777	1,148,267	3,880,816	4,065,100	1,300.7	110,158.1	4,765,234	1,763.6	77.0
16	16	1,470,050	15,741	240,115	363,337	100.0	7,111.4	1,111,333	133.0	0.7
17	17	477,774	3,878	8,047	5,775	80.8	981.1	12,393	0.8	0.3
18	18	4,758,746	290,446	678,440	1,112,373	33.6	32,777.8	5,117,434	475.0	2.5
19	19	0.14	0.03	0.11	0.11	0.2	0.1	0.1	0.1	0.1

SECTION 3

EXPENDITURE AND REVENUE ASSIGNMENTS

The Assignment of Expenditure Responsibilities

The starting point for the analysis of a system of intergovernmental fiscal relations in any country, including Florin, should be the current assignment of expenditure responsibilities. We wish to achieve an assignment of expenditure responsibilities that complies with the principles of sound fiscal federalism, while we also need to be sure that the factual assignment of responsibilities coincides with the *de jure* (legal) assignment of expenditure responsibilities.

In the model, the user has no opportunity to change the assignment of expenditure responsibilities. As noted earlier, the new Local Government Act assigns District Councils the responsibility for a number of government functions, including:

- local government administration, including registration of births and deaths
- primary and secondary education,
- community development,
- maintenance of local roads,
- fire prevention and emergency services
- other (minor) local government functions.

The GoF is intent on devolving these responsibilities in the coming fiscal year as legislated, and the President has ordered all line ministries to prepare to devolve the necessary functions.

In order to devolve the relevant functions to the District Councils, the President has tasked the line ministries to prepare sectoral budgets for each district for the first year after devolution, based on historical spending patterns. As a result, for the first year District Councils are given sectoral expenditure budgets for education and community development. In addition, the Ministry of Local Government has also prepared estimates for administrative and other local expenditures for each district. These estimated expenditure needs for each district are contained in columns M, N and O in the DATA worksheet.³

Revenue Assignment

A basic rule of fiscal decentralization is that “finance follows function.” As such, the manner in which revenues are assigned between the central government and the local governments is crucial to both the vertical balance of the system (the overall distribution of resources between different levels of government) as well as the horizontal equity (a minimum degree of equal fiscal opportunity among districts).

Whereas previously all revenue sources in Florin were assigned to the central government, the new Local Government Act assigns the property tax and some other minor revenue sources to the local government level (see Column Q of the DATA worksheet). Since these own source revenues provide insufficient funding for the devolved local government activities, an important role is envisioned for a system of intergovernmental transfers.

³ It should be noted that as district councils are given budgetary autonomy, each region will be able to make discretionary changes in their spending levels. Unfortunately, a deterministic simulation model does not allow the user to simulate specific changes in spending patterns for any particular district.

SECTION 4
ALLOCATION OF INTERGOVERNMENTAL TRANSFERS

According to recent amendments to the Constitution of the Republic of Florin and the new Local Government Act, two types of intergovernmental transfers will be put in place, namely sectoral block grants (specifically, the Education Fund and Community Development Fund– these transfers are earmarked and their funds can be used only for activities in the sector for which they are designated by the central government) and unconditional transfers from the Equalization Fund (these transfers are lump-sum and can be used for any purpose by the local governments).

The allocation of transfers in the model takes place in two steps. First, the user needs to determine the aggregate amount of funding made available for the various types of transfers. Second, the model also allows the user to determine the allocation formula with which the Equalization Fund is to be distributed among local governments.

Sectoral Block Grants

According to Florin’s Local Government Act, sectoral block grants consist of “money givento local governments to finance local governments activities for selected functions and shall be expended only for the sectoral activities for which they were made available.” Important reasons why the GoF wishes to rely on sectoral transfers include to assure vertical balance in a horizontally equitable manner, to correct for inter-regional spillovers, or to stimulate spending in policy areas that are considered a national priority.

In the model, the user determines the aggregate amount of funding made available for the various types of transfers. In the POLICY worksheet, these amounts (in thousands of Florin dollars) should be entered in cells E8, E9 and E10, respectively.

However, political consensus has already been reached regarding the distribution of the Education Fund and the Community Development Fund. For example, agreement has been reached between the Ministry of Local Government and the Ministry of Education that the Education Fund will be allocated between the districts in proportion to the number of school-aged children in each district. Similarly, the Community Development Fund will be allocated in proportion to the number of residents below the poverty line.

The distribution of the Education Fund and the Community Development Fund takes place in columns D-E, and G-H of the SIM worksheet. The use of allocation factors is discussed later in this section. The mechanics of the simulations are discussed in Section 5. In the SIM worksheet, the allocation factor's name and number for the sectoral funds are contained in red cells because they are predetermined and cannot be determined by the user.

The Equalization Mechanism

Equalization transfers in Florin are legally defined as "...money to be paid to local governments for the general purpose of funding local government activities. Equalization transfers should be allocated on the basis of districts' needs and economic potential in such a manner to assure adequate and equitable funding for all districts."

Practically, this means that the equalization transfers in Florin should be designed to provide funding for all districts based on measures of fiscal needs and fiscal capacity (“economic potential”), and to assure that additional resources are allocated to the least developed districts. As pointed out in Part One of this module, the main challenge in providing equalization transfers is to arrive at acceptable measures of fiscal need and fiscal capacity. Since the GoF wishes to use a multi-factor weighted allocation formula (discussed below), we will have to be sure to include factors in the formula that capture both districts’ levels of fiscal capacity as well as proxies for the districts’ expenditure needs.

In their Fiscal Decentralization Policy statement, the GoF has indicated their preference for a standard, transparent allocation mechanism. The traditional formula-based approach for distributing resources across regional or local governments has been the allocation of funds based on a number of weighted factors. The approach is relatively simple. First, a number of "factors" (such as population, land area, and so on) are selected. Second, it is determined how important each factor will be in the final allocation of transfers by assigning relative weights to each factor. Third, for each factor, a local government will receive its share of funds in proportion to that factor.

An example may be illustrative. First, it might happen that population and land area are selected as factors to be used in the allocation formula. Next, the Local Government Finance Committee assigns weights to these factors. For instance, it could determine that 80 percent of a transfer fund is to be allocated in proportion to each district’s population, while 20 percent of the total fund is assigned in correspondence with land area. Thus, if a

local government district contains 5 percent of the national population and 4 percent of the land area, this district would receive 4.8 percent of the funds available for equalization, or $(0.80 * 5\%) + (0.20 * 4\%) = 4.8\%$.

When expressed in a formula (as is often done for the purpose of legislation), the formula would look like:

$$\text{Transfer for Local Government (i) = } [a_1 (x_1 / X_1) + a_2 (x_2 / X_2) + \dots + a_n (x_n / X_n)] * F$$

Note that this can be re-written to the mathematically equivalent and perhaps more intuitive expression:

$$\begin{aligned} \text{Transfer for Local Government (i)} &= (x_1 / X_1) * a_1 F \\ &+ (x_2 / X_2) * a_2 F \\ &+ \dots \\ &+ (x_n / X_n) * a_n F \end{aligned}$$

where: F is the amount to be allocated among all local governments;

where: $a_1 + a_2 + \dots + a_n = 1$;

and where: x / X represents the share of each factor that is present in the local government area for the local government vis-a-vis the entire country.

The Computation of Allocation Factors

The computation of allocation factors in the model takes place in the FACTORS worksheet, using data entered in the DATA worksheet. A number of allocation factors are

already computed. Additional space is provided for the user to define more factors. The worksheet allows the user to define up to 20 factors, in order to experiment with different allocation formulas. Each factor is numbered.

An example might be helpful to understand the mechanics of computing allocation factors. Imagine that the Local Government Finance Committee would like to allocate a portion of the Equalization Fund in proportion to the population of each district. District population data is presented in column D of the DATA worksheet, while allocation factor is computed in column D of the FACTORS worksheet. The data suggest that Boer District has 783,796 residents (shown in cell DATA!D12), while Florin's total population is 19,643,717 (DATA!D27).⁴ The proportion of Florin's population living in Boer District is defined in cell D12 in the FACTORS worksheet:

Relative share of factor = Population in Boer District / Total Population

$$=DATA!D12/DATA!D$27^5$$

$$=783,796 / 19,643,717$$

$$= 0.0399$$

This suggest that 0.0399 (or to 3.99 percent) of Florin's population resides in Boer District. Hence, Boer District will receive 3.99 percent of any transfers allocated in proportion to the factor population.

⁴ In Microsoft Excel, the use of an exclamation mark in a cell reference refers to the name of a worksheet. Thus, DATA!D12 refers to cell D12 in the DATA worksheet. This construct allows references to be made between different worksheets.

⁵ The dollar sign (\$) in the cell reference indicates that it is an "absolute cell reference." It assures that the reference to row 27 does not change when you copy the formula.

The Selection of Allocation Factors and Weights

The Local Government Act mandates that equalization transfers should be allocated based on districts' needs and economic potential in such a manner to assure adequate and equitable funding for all districts. The simulation model allows the user to select up to six measures of fiscal need as allocation factors for the Equalization Fund.

In column C of the POLICY worksheet, the user should simply select the identification number of the desired factor that is indicated in bold in the FACTORS worksheet. For example, select factor number "1" if you would like to allocate transfers in proportion to the overall population; select factor number "2" if you would like to allocate transfers in proportion to the infants and children aged 0-5; and so on. The user assigns relative weights to each allocation factor in column G of the POLICY worksheet. Since all weights should add to 100 percent, one of the weights is determined by default.

The use of allocation factors to distribute funds among local governments presumes that there is a proportion relationship between the factor used and the fiscal need of a local government. For example, a local government that has a higher incidence of poor households will face a proportionally higher need for social welfare expenditures. However, not all allocation factors necessarily reflect local fiscal needs. Equalization formulas may also be used to engage in fiscal capacity equalization or to stimulate local fiscal effort.

Fiscal Capacity Equalization.

One possible allocation factor that could be used for the distribution of equalization funds

in Florin is fiscal capacity. Fiscal capacity can be defined as a district's *ability* to collect revenues (in other words, how much revenue would a district be able to collect if it were to use standard or national average tax rates and an average level of administrative effort). Fiscal capacity varies from district to district because wealthier districts are generally better able to collect revenues than others. However, it is important to understand that a district's fiscal capacity is not the same as the amount of revenue that a district actually raises, because not all districts try equally hard to collect revenues. A common measure of subnational fiscal capacity is a district's per capita personal income. The example contained in the simulation model uses per capita personal income as a proxy for the ability of a district to raise own source revenues. In Part One of this module, Section 3.3 and Box 4 provide a detailed conceptual discussion of fiscal capacity as well as a variety of fiscal capacity measures, including the Representative Revenue System.

Unlike in an earlier example, where our purpose was to provide funding in proportion to measures of fiscal need (such as population, school-aged children or poor persons), fiscal capacity equalization often only involves providing transfers to regions that have below-average fiscal capacity. In Section 3.2 of Part One of this module, we discussed the procedure needed to achieve this:

- C Measure Fiscal Capacity
- C Define the fiscal capacity gap for each local government:
 - If Fiscal Capacity > Average Fiscal Capacity, then Capacity Gap = 0.
 - If Fiscal Capacity < Average Fiscal Capacity, then
$$\text{Capacity Gap} = \text{Average Fiscal Capacity} - \text{Fiscal Capacity}$$
- C Define the transfer to each local government:

$$\text{Transfer to Subnational Government}_i =$$

$$\left(\text{Capacity Gap}_i / \sum \text{Capacity Gap}_i \right) * \text{Fund}$$

The computation of this fiscal capacity gap is contained in columns T-V of the DATA worksheet, while the allocation factor for below-average fiscal capacity is contained in column J of the FACTORS worksheet. The distribution of fiscal capacity equalizing transfers is determined in the model in a number of steps:

- Step 1: Select the measure of fiscal capacity that will be used and determine the average level of fiscal capacity. In the model, the national average level of per capita personal income is determined in cell DATA!T27 as total personal income (for all districts) divided by the size of the national population.
- Step 2: Establish the level of personal income that each district would have if it had an average level of fiscal capacity (i.e., national average per capita income multiplied by each district's population; column U).
- Step 3: Determine the "fiscal capacity gap." The fiscal capacity gap is defined as the difference between average fiscal capacity for a district (contained in column U) and actual fiscal capacity (contained in column I). All districts that have an above-average level of fiscal capacity are assigned a gap equal to zero. In formula terms, this is expressed as "`=IF(I12>U12,0,U12-I12)`".⁶

⁶ The IF function in Microsoft Excel returns one value if a condition you specify evaluates to TRUE and another value if it evaluates to FALSE. See Microsoft Excel's help function for a detailed discussion of the IF function.

Step 4: Compute an allocation factor in proportion of the fiscal capacity gap for those districts that have below-average fiscal capacity. This means that these districts would receive a capacity-equalizing transfer in proportion to the gap between their actual fiscal capacity and average fiscal capacity. Fiscal capacity then simply becomes an allocation factor that can be defined in FACTORS (column J) and selected in the POLICY worksheet (as factor number “7”).

An important remarks ought to be made with regard to the manner in which fiscal capacity equalization has been included in the simulation model. The model demonstrate only one approach to including a fiscal capacity measure in the equalization mechanism. There are certainly other approaches that can be used to achieve fiscal capacity equalization, although many are similar in nature to the one displayed in the model. Alternative approaches may be more or less equalizing depending on the specific details of the mechanism used. For instance, as opposed to giving every below-average district a small transfer, the mechanism could also be designed to allot larger transfers to only the poorest districts.

Fiscal Effort

In addition to using the Equalization Fund to equalize for fiscal capacity and fiscal need, the fund could potentially also be used to stimulate fiscal effort. Again, this could be achieved by defining an allocation factor for those district’s that exert an above-average level of fiscal effort. Fiscal effort is defined as the effort with which a local government mobilizes own source revenues, or more formally, as the degree to which a government or subnational government utilizes the revenue bases available to it. Fiscal effort is typically calculated either as (1) the ratio of actual revenue collections to the revenues that would

have been collected if the local government had applied (national) average rates and collection efforts to its tax bases, or (2) more generally as the ratio of actual revenue collections and fiscal capacity.

Similar to the approach used to calculate the fiscal capacity gap, we can define an allocation factor for fiscal effort:

Step 1: Define fiscal effort as the ratio of own source revenue collections and fiscal capacity (in our case, personal income) and compute the average level of fiscal effort for the nation.

Step 2: Compute how much revenue each district would collect if they would exert an average level of fiscal effort (determined as the district's level of fiscal capacity multiplied by the average level of fiscal effort).

Step 3: Reward those districts that exert above-average fiscal effort in proportion to the amount that they collect in excess of the average.

An allocation factor for fiscal effort is defined in Columns X-Z in the DATA worksheet. Column X specifies what share of personal income is collected in local taxes in each district; the national average level of fiscal effort is contained in DATA! X27. Column Y computes how much each district would collect if they would apply the national average level of fiscal effort. Those districts that exert below-average fiscal effort (and thus, for whom actual collections < collections under an average level of effort) receive no transfers.

However, districts that exert above-average fiscal effort (and thus, for whom actual collections > collections under an average level of effort) receive a transfers in proportion to the amount that they collect in excess of the average (actual collections minus collections

under an average level of effort). Finally, “above-average fiscal effort” is included as an allocation factor in the FACTORS worksheet (column K) as factor number “8”.

SECTION 5

SIMULATIONS AND ANALYSIS

Based on the data contained in DATA, the allocation factors computed inFACTORS, and the parameters selected in the POLICY worksheet, the model simulates an alternative allocation of resources for all districts in Florin. The simulation of transfers for each district is contained in the SIM worksheet. The SIM worksheet then pulls together the three components (local expenditures, own source revenues and transfers) and expresses these simulated variables in per capita terms.⁷ The SIM worksheet also contains programming used for incidence regressions that are included in the ANALYSIS worksheet. Since the spreadsheet model is programmed as transparently as possible, the user should be able to trace each step of the simulations through the model.

Simulations

It would be beneficial for all to know how the simulation model actually computes the simulated transfer amounts. An illustrative example might be useful.

Let us presume that we wish to distribute one billion Florin dollars through the Equalization Fund (i.e., enter 1,000,000 in POLICY!E10; note that amounts are expressed in

⁷ As an informational item, the SIM worksheet also reports the budgetary balance (surplus or deficit) for each region that results from the simulated system of intergovernmental fiscal relations. A positive amount would indicate an aggregate local budget surplus, while a negative amount would be indicative of an aggregate local budget deficit. Interpretation of this budget balance is subject to all the modeling limitations which are specified in the previous sections.

thousands of dollars). Let us then select to allocation factors: population (in column C, select factor number "1") and land area (factor number "6"). Then, let us opt for a weighting scheme where 60 percent of the Equalization Fund is allocated according to population, and 40 percent is allocated proportional to land area. This is achieved by selecting a weight of 40 percent for the factor land area: enter "40" in POLICY!G17. If all other factor weights are set equal to zero, population will be assigned a weight of 60 percent by default.

Next, let us turn our attention to the columns J and K of the simulation (SIM) worksheet. First, the model repeats the crucial information from the POLICY worksheet in the light green cells. Using the terminology coined in Section 4 above, $a_1 = 0.6$, $a_2 = 0.4$, and $F=1,000,000$. As a results, the amount of money distributed in accordance with the first factor (population) equals FL\$ 600,000 ($a_1 F$) , while FL\$ 400,000 ($a_2 F$) will be allocated according to the second factor (land area).

Based on the selected factors, the worksheet using the INDEX function to retrieve the data on the selected allocation factors from the FACTORS worksheet.⁸ The relevant allocation factors are thus simply copied from the FACTORS worksheet to columns J and K in the SIM worksheet. If additional factors had been selected, they would be contained in columns L-O.

The final determination of the Equalization Fund transfer is made in column P of the

⁸See Microsoft Excel's help function for a detailed discussion of the INDEX worksheet function.

simulation worksheet. For clarity, let us illustrate how the allocation formula in Section 4 translates into an actual transfer amount for Boer District. This amount is computed in cell SIM!P12:

$$\begin{aligned}
 \text{Allocation for Boer District} &= (x1 / X1) * a1 F + (x2 / X2) * a2 F \\
 &= a1 F * (x1 / X1) + a2 F * (x2 / X2) \\
 &= (\$J\$8*J12)+(\$K\$8*K12) \text{ }^9 \\
 &= 600,000 * 0.0399 + 400,000 * 0.0978 \\
 &= 63,042
 \end{aligned}$$

Analysis Worksheet

To aid in the analysis of the simulation results, several tables are presented in the ANALYSIS worksheet. The results in these tables are automatically recalculated when the user changes any of the policy parameters contained in POLICY. Additional analytical tables of interest could easily be created.

Table 1 looks at vertical fiscal balance in the system of intergovernmental fiscal relations. One simplistic way to analyze the vertical fiscal balance is to study the budget balance of

⁹ The complete formula in cell SIM!P12 is $=(\$J\$8*J12)+ (\$K\$8*K12)+ (\$L\$8*L12)+ (\$M\$8*M12)+ (\$N\$8*N12)+ (\$O\$8*O12)$. Since only the first two allocation factors are used, the latter portion of the formula equals zero.

each level of government.¹⁰ The relative budgetary position of each level of government would be a reflection of vertical fiscal imbalances if (a) each level of government is equally efficient in allocating its resources to achieve its responsibilities and (b) there are no institutional constraints on governments at every level to incur budget deficits. For example, if local government statistics showed a large consolidated fiscal deficit while the central government budget achieved a balanced budget or a budget surplus, this would suggest a vertical imbalance of the system of intergovernmental fiscal relations in favor of the central government. If these assumptions would hold

Table 2 presents an overview of the simulated allocation of transfers. The table highlights the relative importance of each transfer fund.

Table 3 examines the horizontal balance of the system of intergovernmental fiscal relations, using regression analysis. Regression analysis can reveal if levels of a variable (the “dependent” variable; for instance per capita local expenditures) systematically vary in response to certain “independent” variables (such as characteristics of local governments). For instance, do districts that have greater fiscal needs receive larger transfers? Do districts that are less able to raise revenues (i.e., that have lower fiscal capacity) receive larger transfers? The regressions contained in Table 3 attempt to answer such questions. (Test statistics are provided below the parameter estimates).

¹⁰ This measure is used here for simplicity. It needs to be kept in mind that deficits/surpluses of government units can be affected by many factors including the own fiscally responsible or irresponsible behavior of these governments.

The first equation in Table 3 seeks to explain the variation in the per capita level of local expenditures for each district. The second, third, and fourth equations explain the level of per capita revenues, per capita transfers, and per capita local budgetary balance, respectively. We tried to explain variations in these fiscal measures based on a number of explanatory variables that reflect variations between districts in fiscal capacity and fiscal need.

In these regressions, per capita personal income is used as a measure of a district's fiscal capacity. As household income rise, districts should be better able to raise own source revenues and will likely spend more on local public goods. If transfers are equalizing (more specifically, if transfers seek to equalize fiscal capacity), then we should find an inverse (negative) relationship between transfers and household income (i.e., when personal income is higher, transfers will be lower).

Two measures of fiscal need were included in the regression equation, namely the share of the population that is not of working age (in other words, the share of the population that is formed by children and seniors) and the poverty rate. Both of these variables are traditional measures of fiscal need. Thus, if transfers are meant to equalize the fiscal needs of districts, then needier districts (for example, with a higher poverty rate) should receive greater transfers.

Note that an approach similar to the one used here for the analysis of the results could be used more broadly to study the incidence of actual fiscal decentralization policies and the performance of equalization systems.