Wage Spending:
Preparing a Baseline Projection

Fiscal Affairs Department

May 2018
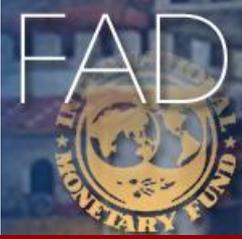
Outline

- **Simulation Modeling as a Tool of Fiscal Policy Analysis**

- **Steps for Building a Simulation Model**

- **The Challenge of Managing Government Wage Spending**

- **A Methodology for Building a Projection Model**

- **Data Requirements and Sources**

- **Wage Bill Modeling in Action: Practical Demonstrations**

Simulation Modeling as a Tool of Fiscal Policy Analysis
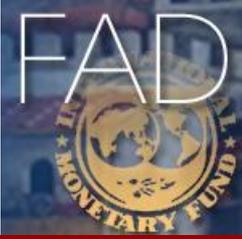
Simulation Modeling as a Tool:
Why Do We Model?

- **Modeling separates the relevant from the irrelevant**

- **In doing so, models identify the real issues that require a policy response**

- **Qualitative and directional conclusions are often more valuable than numerical output**

- **The end-goal is a nuanced understanding of:**

    - The nature of the problem; and

    - The trade-offs inherent in resolving it
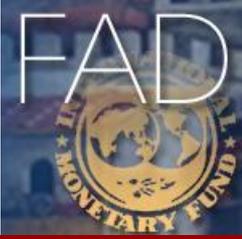
Simulation Modeling as a Tool:
When Do We Model?

- **Simulation modeling is time-consuming and resource-intensive. When is it worth doing?**

- **Models are needed when there are interactions between variables, feedback loops, or lagged responses. In such cases, intuition is often wrong**

- **Other times when models are needed:**

  – When something changes

  – When the stakes are high

  – When the return-on-investment (ROI) is large
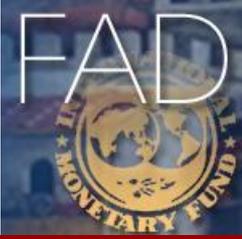
Simulation Modeling as a Tool:
The Benefits of Modeling

- <u>Baseline</u>: by generating a baseline projection (i.e., in the absence of reform), wage bill models illuminate the potential magnitude and trajectory of spending over time

- <u>What-If Analysis</u>: by simulating the impact of changes in macroeconomic and policy variables, wage bill models illuminate how wage spending might evolve if the baseline's assumptions prove to be wrong

- <u>Reform Costing</u>: by estimating the fiscal impact of policy measures against the baseline, wage bill models provide a means to: (i) calibrate the potential savings from individual policy measures and packages of policy measures and (ii) tailor measures to attain a given fiscal target
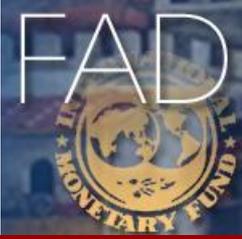
Simulation Modeling as a Tool:
Lessons Learned

- **Models are powerful: use the power prudently**

- **Respect the policy process**

- **The hardest challenges are rarely technical**

- **Build the right tool for the problem**

- **Models are not an "end product" but a process**

- **Institutionalizing models requires:**

  - A champion

  - Internal demand

  - Organizational commitment

Steps for Building a Simulation Model
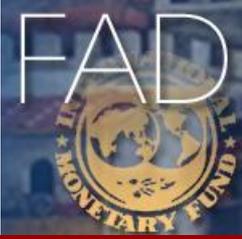
Steps for Building a Simulation Model:
Modeling is a Process

- **Models are organic:**
  - Good ones evolve and expand in usefulness
  - Bad ones wither and die

- **Planning is key:**
  - Understand the problem to be solved
  - Build consensus around the tool to be built

- **Stick to the sequence:**
  - Most modeling projects involve six basic steps
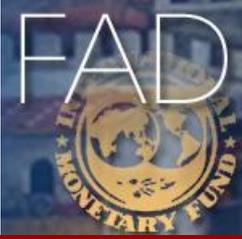
Steps for Building a Simulation Model:
Overview

- **Step 1:   Identify Conceptual Ingredients**

- **Step 2:   Establish Logical and Quantitative Relationships**

- **Step 3:   Pick a Platform**

- **Step 4:   Construct the Model**

- **Step 5:   Deploy the Model**

- **Step 6:   Institutionalize the Model**
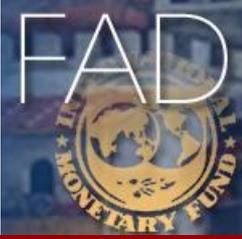
Steps for Building a Simulation Model:
Identify Conceptual Ingredients

- **Decisions: what are the *choices* to be made?**

- **Objectives: what are the *outcomes*? How are they *measured*?**

- **Variables:**

  - Policy knobs

  - Assumptions

  - Constraints: logical, practical, and political

Meta-lesson: you cannot model a problem you do not understand…
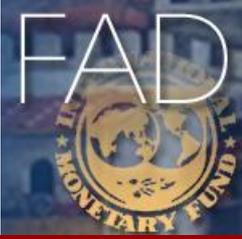
Steps for Building a Simulation Model:
Establish Logical and Quantitative Relationships

- **Define the variables**

- **Identify the time horizon**

- **Depict the relationships**

  – Flow charting

  – Precedents

  – Dependents

- **Apply the "relevance" criteria**

- **Identify sources for data**

Steps for Building a Simulation Model:
Pick a Platform
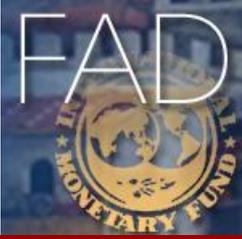
- **Consider who will use the model and how they will use it**

- **Build for the least-skilled user**

- **Respect the trade-offs between: (i) elegance & transparency; (ii) accuracy & ease-of-use**

- **Be aware: policy makers mistrust a "black box"**

- **The best platform depends on the context**
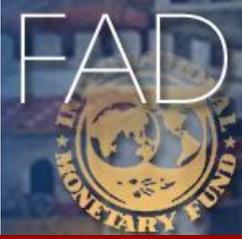
Steps for Building a Simulation Model:
Construct the Model

- **Build models with an eye to the future:**
  - Good tools often get redeployed beyond their initial mandate
  - Never hardwire anything which can be treated as a variable

- **Organize the model appropriately:**
  - Assumptions and policy knobs
  - Output
  - Computational engines
  - Source data

- **Use modules to facilitate reproducibility and scaling**
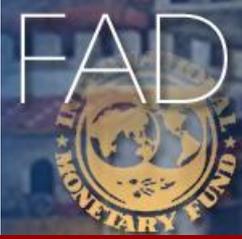
Steps for Building a Simulation Model:
Deploy the Model

- **Validate the model**

- **Document the methodology**

- **Develop a baseline**

- **Exercise the model for:**

  – <u>Qualitative insights</u>: what's important, what's not, directional trends, sensitivity of outcomes to policy choices

  – <u>Quantitative</u> implications

15

- **Institutionalizing a model is often challenging and absolutely requires:**

  – <u>Technical Expert</u>: the person responsible for running the model must be an expert in its construction

  – <u>Internal Champion</u>: the ultimate "buyer" of the model must champion its use and have the resource authority and willingness to invest in its updating and development

16

Steps for Building a Simulation Model:
Lessons for Managers
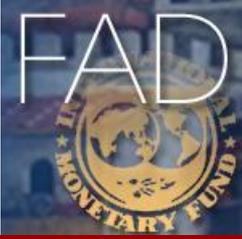
- Be involved in the model's construction, particularly during the initial phases

- Get your hands dirty: if you do not understand the methodology, you may misinterpret the output

- Recognize that developers: (i) do not always understand the public policy issues they are being asked to model and (ii) cannot build a tool to meet your needs if you fail to delineate them

- Use the developer as your tutor; don't be afraid of what you do not understand; the technical elements are less important than the concepts and methodology

- Champion the model's use and support its institutionalization with manpower, budget, and leadership

17

The Challenge of Managing Government Wage Spending
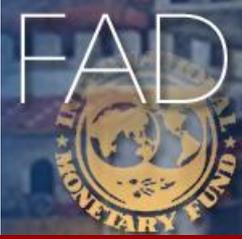
Challenge of Managing Wage Spending:
Wages Constitute a Large Share of Spending

- **Government wages underpin the provision of key public services, such as education, health, sanitation, and security**

- **Delivering services efficiently is crucial for social prosperity and inclusive growth**

- **As a share of GDP, wage spending ranges from about 7 ½ percent (low-income countries) to about 10 percent (advanced economies)**

- **In the future, many countries will face rising fiscal pressures:**

  - Increased demand for public services

  - Binding revenue and financing constraints

  - Baumol's "cost disease"

  - Population aging and its impact on healthcare and pension spending
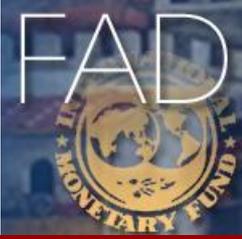
Challenge of Managing Wage Spending:
Policy Levers Are Few and Constrained

- **Coping with long-term fiscal pressure will necessitate greater budget efficiency from all spending, including wages. This will require:**

  - Appropriate employment: the level and composition of government employment must be aligned to the public services being provided

  - Competitive compensation: the level and composition of government compensation must be competitive with the private sector

- **Managing the wage bill is often made more difficult by:**

  - The statutory nature of government compensation

  - The strong labor protections typically provided to government workers

  - The influence of public sector unions over compensation and hiring policies, and other factors.

  - Weaknesses in both public financial management and human resource management.

Consequently, it can be difficult to adjust wage spending to accommodate short- and medium-term fluctuations in budgetary resources and to manage employment in response to long-tem technological and demographic developments

A Methodology for Building a Projection Model
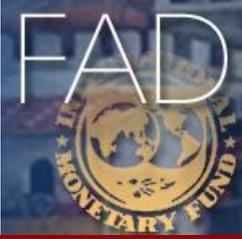
Methodology:
The Objectives and Data Are Determinate

- The appropriate methodology for projecting wage spending depends on the objectives of the fiscal policy analysis and the data available to support it

- Crude projections can be developed on the basis of just aggregate headcounts and compensation data

- Beyond the problem of accuracy, simple methodologies cannot capture the complexities of government compensation and employment policies and, consequently, lack the functionality to estimate the fiscal impact of a broad range of policy reforms

- In general, granular data yields the most accurate projections and enables the costing of reforms that target specific elements of compensation or specific groups of workers
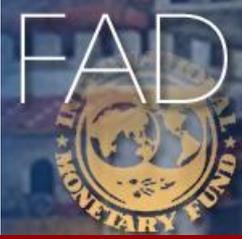
Methodology:
The Choice of Computational Platform

- **Wage bill projection models can be constructed using a variety of computational platforms**

- **The choice of platform is typically determined by the questions the model is being built to answer and its audience of potential users**

- **While statistical software packages (e.g., STATA) are flexible, efficient, and powerful, they may exceed the technical capacity of some users and are less transparent and approachable than spreadsheet programs, such as Microsoft Excel**

- **Excel is often the best choice for wage bill modeling, particularly if multiple staff are expected to use and revise a model on an ongoing basis**
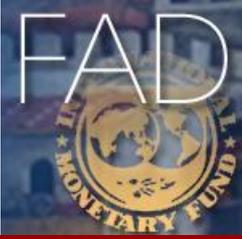
Methodology:
Respect the Tradeoffs

- **When models are built in Microsoft Excel, it is important to recognize – and respect – a trade-off that often emerges between:**

  - Computation accuracy – whereby data are disaggregated and every feature of compensation and employment policy is captured by the model – versus

  - Ease-of-manipulation

- **In this regard, decisions regarding a model's structure and its underlying computational algorithms should always be guided by the policy-level questions the model is intended to answer**

- **Time invested up-front in model design is rarely wasted because complex Excel models, once completed, can be tricky to disassemble and modify**
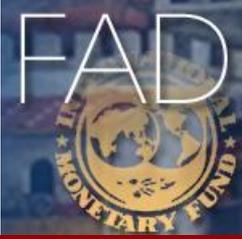
Wage Spending Deconstructed: Compensation (1/2)

- **The elements of compensation include not only wages and salaries but also the cost of:**

    - Overtime pay, paid leave, bonuses, merit pay, and any supplements paid to workers with special skills or qualifications, longevity, or who work in hazardous or difficult conditions

    - Allowances for housing, transportation, and other expenses

    - Medical, dental, and vision care (or the government's share of the premiums paid for insurance programs that provide such coverage)

    - Benefits for accidental death or dismemberment, mortality, and other forms of insurance

    - Pensions and other retirement benefits (including any contributions paid by the government as an employer toward such programs)

    - Other forms of deferred compensation

- Disaggregating the elements of compensation in forecasts is recommended because it enables the estimation of savings from policies that target allowances and other forms of compensation separately from wages and salaries

- While the cost of old age pensions, disability pensions, and the benefits paid to the survivors of deceased government workers are sometimes considered separately from wages – particularly when paid on a pay-as-you-go basis – they are elements of compensation and are logically part of wage spending

- The objectives and scope of the fiscal policy analysis should ultimately determine whether such costs merit inclusion

- Nonmonetary benefits, such as job security, may be of considerable value to government workers but are generally not included in the calculation of wage spending
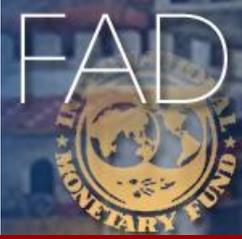
Wage Spending Deconstructed: Employment (1/2)

- The purpose/scope of fiscal policy analysis will determine the population of government workers to include in the computation of wage spending

- Most commonly, wage bill projections are intended to support fiscal planning at the level of the central government and, therefore, include only workers paid directly by the central government's budget

- Conceptually, however, wage spending can also include remuneration paid by subnational levels of government, such as states and municipalities, and by public corporations

- In situations where public corporations have their own revenue sources (i.e., are partly self-financing), it becomes conceptually impossible to distinguish the government's budgetary support for wage spending from other forms of expenditure support
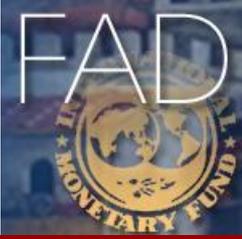
Wage Spending Deconstructed: Employment (2/2)

- The population of government workers included in the computation of wage spending includes not only regular fulltime employees but also temporary and intermittent workers

- The compensation paid to contractual employees, while conceptually part of the wage bill, is sometimes recorded as part of goods and services and excluded from wage bill forecasts

- The compensation paid to local staff by donor partnerships is also often excluded

- In some countries, sensitivities surrounding spending on security and defense preclude their inclusion in wage bill forecasts
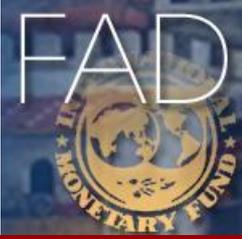
Methodology:
Conceptual Overview

- **The size of the wage bill is determined by the number of government workers and the cost of their compensation**

- **Start by replicating the government's wage bill in the current year – or the most recent year for which data is available**

- **Use age-specific matrixes to track the evolution of:**

  – The number of workers

  – Their mean compensation over time

Methodology:
A Basic Equation

- **Mathematically, the wage bill (WB) in year (t) is defined as:**

$$WB_t = \sum_{j=x}^{y} N_t^j \times \left(W_t^j + A_t^j \right)$$

- **Where:**

  – N denotes the number of workers in a given age-cohort

  – W denotes that cohort's mean wages or salary (i.e., the mean wage or salary earned by all workers in the cohort)

  – A denotes their mean allowances and other nonwage elements of compensation

  – j represents an age-cohort (i.e., all workers of a particular age)

  – x denotes the earliest age of entry into the government workforce

  – y denotes the oldest age workers can attain
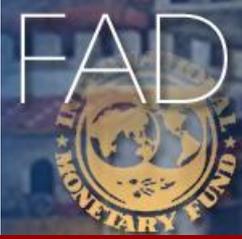
Methodology:
The Case for Disaggregation

- **Allowances and other nonwage compensation can be disaggregated into individual elements of compensation, depending upon the objectives of the analysis**

- **It is often helpful to disaggregate the government workforce into sectors (e.g., education, health, security/defense, and other):**

  – Given heterogeneity in the age distribution of government employees and their compensation

  – Because doing so creates the capability for the model to simulate sector-specific options for policy reform

Methodology:
Forecasting Changes in Compensation

Forecasting Changes in Compensation (1/3)

- **Mean wages (W_t^j) and mean allowances (A_t^j) evolve over time in response to the statutory provisions governing government compensation and ad hoc decisions made by the authorities**

- **Typically, three policy inputs are used:**

  - Input variable representing the annual rate of increase in wages and salaries (typically specified as a vector so different values can be entered for each year of the projection period)

  - An input variable representing the rate of increase in allowances and other nonwage compensation (also specified as a vector)

  - Input variable intended to capture the impact of wage drift on mean wages and salaries
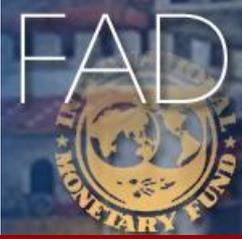
Forecasting Changes in Compensation (2/3)

- **In countries where wages are formally indexed, the rate of increase in wages and salaries can be set equal to projected inflation**

- **In countries where wages are adjusted on an ad hoc basis, historical data – in combination with representations from the authorities – often provide a reasonable starting point**

- **Because the composition of individual age-cohorts changes as some workers leave and others enter the workforce, a weighted average is required to compute changes in mean wages and mean allowances over time**
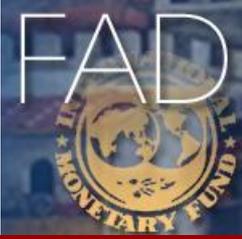
- **Wage drift refers to factors that drive wage growth independently of broader decisions regarding the overall size of the workforce or wage-levels**

  - Automatic increases in wages and salaries

  - Patterns of promotion

  - The reclassification of employment positions, and other

- **Conceptually, the wage drift variable is intended to capture all factors that collectively create upward pressure on wage spending independent of policy decisions**

- **Can be estimated using microsimulation on the basis of wage tables, the rules regarding advancement, and the distribution of workers by grade and level**

Methodology:
Forecasting Changes in Employment
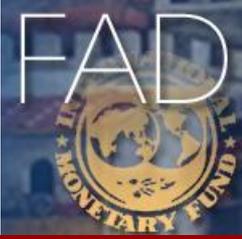
- **The number of workers in a given age-cohort (N_t^j) changes as a function of the number of:**
  - New hires
  - Workers who depart the workforce prior to reaching the age of eligibility for retirement benefits
  - Workers who retire
  - Workers who die while still working.

- **The number of hires is a policy choice and is one of the most important policy inputs in a wage bill projection model**

- **Can be specified using a year-specific input variable for headcount replacement (i.e., the ratio of new hires to departing workers)**

- **Such a specification is convenient because "100 percent" results in the workforce remaining stable from one year to the next**
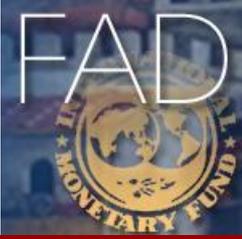
- **The number of new hires can be estimated using:**

  - Formalized staff development plans

  - Political representations regarding public sector employment

  - Historical data

  - Demographic trends

    - Hiring patterns for the education sector, for example, typically track the population of school-age children

    - Hiring patterns for the health sector typically track the rate of growth in the overall population or the old-age population
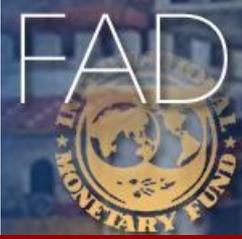
Forecasting Changes in Employment (3/3)

- The age distribution of new hires – as well as age-specific probabilities associated with departures and retirements – are typically estimated using historical data

- Age-specific death rates can be sourced from the Population Division of the Department of Economics and Social Affairs of the United Nations

- In cases where the modeling horizon extends only for three to five years, the impact of preretirement mortality is typically immaterial and can be ignored

Methodology:
Practical Steps
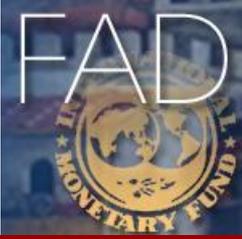
- **Ensure the model reproduces the wage bill in the first year. Employee-level records may not account for all wage spending because of:**
  - Errors in human resource management/payroll databases
  - Compensation paid to workers who are not covered by the payroll system
  - Elements of compensation that are not captured by employee records.
  - Typically handled by scaling headcounts, wages, or nonwage compensation, depending upon the nature of the discrepancy

- **Validate the model and ensure that it produces credible results when assumptions and input variables are changed**

- **Generate a baseline that incorporates existing wage-setting and employment policies, formalized plans, and historical trends**

- **Macroeconomic variables – e.g., real GDP growth, real wage growth, and inflation – should be consistent with internal forecasts**

- **Wage spending should be expressed not only in units of local currency but relative to GDP to facilitate fiscal policy discussions**

40

Data Requirements and Sources

Data Requirements and Sources:
Using Anonymized Employee Records
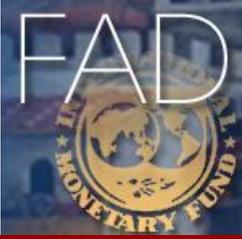
- **Most human resource/payroll management IT systems can support the extraction of the data required to generate and compile anonymized records for wage bill forecasting. The following fields are typically used:**

  - The employee's year of birth (used to aggregate workers into age-specific cohorts)

  - The employee's year of entry into the government workforce (used to create an age-distribution for newly hired workers, for distributional analysis, and, in some instances, for computing retirement benefits)

  - Compensation disaggregated by wage or salary, overtime, bonus, allowances and supplements, and other elements of remuneration

  - The government's share of contributions for social insurance and other retirement savings schemes

  - Basic employment data, such as the employee's ministry, department, or agency and, in some cases, job title or employment classification code

Wage Bill Modeling in Action:
Practical Demonstrations
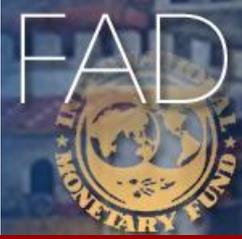
Practical Demonstrations:
From Prior IMF TA Missions

- **Architecture of a wage bill model:**
  - Raw data
  - Processed data
  - Computation engines
  - Inputs and outputs
  - Exhibits (tables and charts)

- **Use of microdata to create distributions for employment-by-age and compensation-by-age**

- **Estimating wage drift using wage tables**