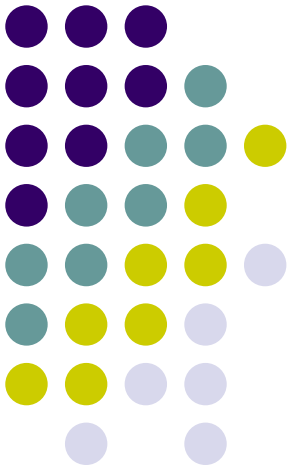
Inflation and Productivity Factors in 3rd Generation IRM

Larry Kaufmann, *Partner*
Pacific Economics Group

Toronto, Ontario
December 14, 2007



Pacific Economics Group, LLC
Economic and Litigation Consulting

Introduction

Staff of the Ontario Energy Board (OEB) is consulting with stakeholders to develop 3rd Generation Incentive Regulation (IRM3) for electricity distributors in the Province.

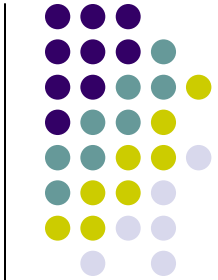
Pacific Economics Group (PEG) is advising on the design of IRM3.

As noted earlier this morning, current thoughts are that a core plan would be an index-based adjustment of allowed distribution prices over the term of the plan.

There are two main components of an indexing formula: an inflation factor; and a productivity factor (aka "X factor"). A major component of PEG's work is to provide advice on the methods for determining, and the associated values, for these factors.

Pacific Economics Group, LLC
Economic and Litigation Consulting

Introduction (Con't)



IRM3 will apply to 80+ utilities that differ in terms of

- Customer and volume growth
- Customer/population density
- Capital investment needs (e.g system age, replacement cycles)
- Ownership

These diverse conditions can impact companies' cost and revenue growth differently

Introduction (Con't)

Distributor diversity therefore an important issue

Particularly for setting appropriate X factors

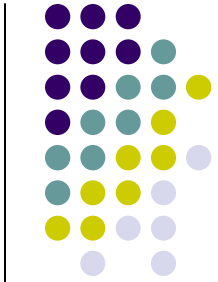
A sustainable IRM framework should put an empirical and methodological foundation in place that can produce appropriate X factors for distributors operating under diverse conditions

>>> Important focus of PEG's work and today's presentation

Pacific Economics Group, LLC
Economic and Litigation Consulting

Table of Contents

Background: Inflation and X Factor Logic



In index-based PBR plans, maximum allowed rates are adjusted by a price cap index (PCI) that contains an inflation factor, X factor and Z factor

In a typical North American price cap filing, the PCI conforms to the competitive market paradigm

Logic: If an industry earns a competitive return, *% change Prices = % change Unit Cost*

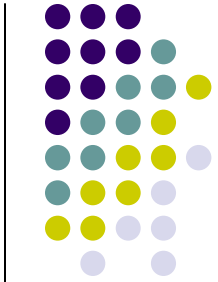
> > > PCI is calibrated to track the industry's unit cost trend

% change Unit Cost = % change Input Prices - % change TFP

TFP = Total Factor Productivity

Pacific Economics Group, LLC
Economic and Litigation Consulting

Background: Review of Inflation and X Factor Logic (Con't)



Most X-factors in approved *North American* price cap plans are *calibrated* to track industry total factor productivity TFP trend

Total Factor Productivity

TFP = Output/Input

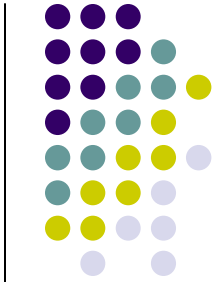
TFP Growth = Changes in Output Quantity minus Changes in Input Quantity

Output quantity and input quantity often measured with indexing methods

Index-based TFP estimates also develop estimates of industry input price measures

TFP can also be estimated econometrically

Background: Review of Inflation and X Factor Logic (Con't)

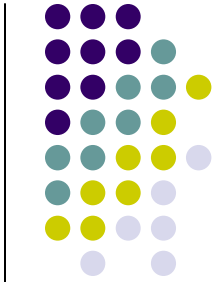


Two kinds of inflation measures are consistent with the competitive market paradigm and frequently used in approved indexing plans

- Economy-Wide Inflation measures
- Industry-Specific Inflation measures

Indexing logic shows that inflation (and X) factors chosen for indexing formula should reflect input price trends for the industry

Background: Review of Inflation and X Factor Logic (Con't)



Indexing logic → relationship Between X Factors and Inflation Factors

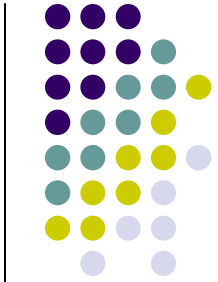
- Industry-specific inflation measure
  - X = industry TFP trend
  - No inflation differential

- Economy-wide inflation measure
  - X = sum of productivity differential and (input price) inflation differential

i.e. $$X = \left(T\dot{F}P^{I} - T\dot{F}P^{E}\right) + \left(\dot{W}^{E} - \dot{W}^{I}\right)$$

Pacific Economics Group, LLC
Economic and Litigation Consulting

Inflation Factor Options



Economy-wide inflation factor

Measure of aggregate inflation in the overall economy

Examples:

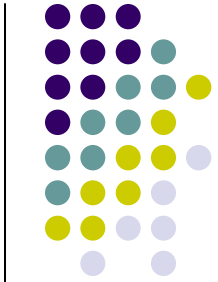
- GDP-IPI
- GDPPI

Precedents:

- IRM2
- Boston Gas
- Bay State Gas
- Berkshire Gas
- Union Gas
- Central Maine Power
- Southern California Edison

Pacific Economics Group, LLC
Economic and Litigation Consulting

Inflation Factor Options (Con't)



Advantages:

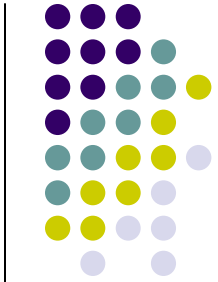
- Simplicity
- Familiarity of inflation measures

Disadvantages:

- Economy-wide inflation may not be a good measure of input price inflation for the utility industry
- Could lead to unreasonable "input price differentials"
- More complexity in X factor formula

Pacific Economics Group, LLC
Economic and Litigation Consulting

Inflation Factor Options (Con't)



Industry-Specific Inflation Measures

Inflation measure tailored to reflect inflation in input prices used in utility industry

Inflation is a weighted average in input price *subindexes*

e.g. inflation = 0.20 x growth P_{Labor} +
0.20 x growth $P_{Other\ O\&M}$ +
0.60 x growth $P_{Capital}$

Information on industry input price inflation available from both public (*e.g.* Stats Canada) and private (*e.g.* DRI) sources

Pacific Economics Group, LLC
Economic and Litigation Consulting

Inflation Factor Options (Con't)

Precedents

Ontario electricity distributors IRM1

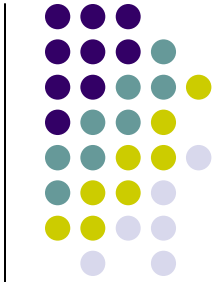
Pacificorp-CA (bundled power)

Southern California Gas

San Diego Gas and Electric – gas distribution

San Diego Gas and Electric – electric distribution

Inflation Factor Options (Con't)



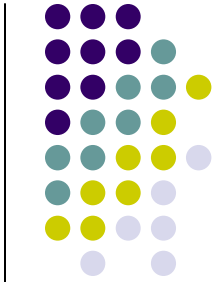
Advantages:

Designed to be a good measure of input price inflation for the utility industry
Reduces business risk (input price volatility or uncertainty of future input price trends)
Eliminates need for input price differential

Disadvantages:

Lack of familiarity
Complexity
Potential Volatility

Inflation Factor Options (Con't)



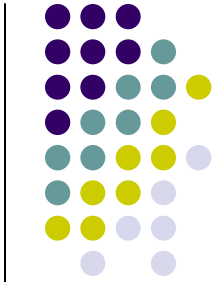
Ontario data exists to construct industry specific inflation factor that is

- Feasible
- Transparent
- Easily updated

Sample industry specific inflation factor has been constructed using Ontario data that is in the public domain

Research on alternative ways to construct an IPI and on ways to smooth potential volatility in prices for capital inputs continues

X Factor Options



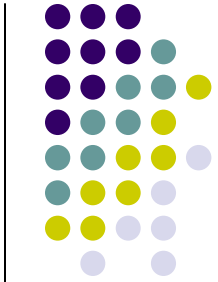
Two main methods can be used to estimate TFP trends

1. Index-based
2. Econometric

Other methods (*e.g.* data envelope analysis, stochastic frontier analysis) have been used overseas to estimate efficiency "frontiers" which, are in turn, used to set X factors

Using frontier methods, X factors are often set to get companies to efficiency "targets" over a defined interval of time (*e.g*. move costs to the frontier over next 10 years)

X Factor Options

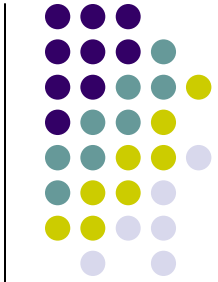


PEG prefers calibrating X factors using estimates of industry TFP trends than frontier-based efficiency targets

Some reasons:

1. Stronger link to indexing logic
2. Average efficiency standard (with stretch factor) more consistent with competitive market paradigm
3. Less confidence in DEA than either indexing or econometric methods

X Factor Options (Con't)



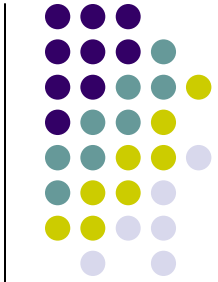
Indexing methods computer measures of comprehensive output quantities (Y) and input quantities (X)

Change in TFP (ΔTFP) is then computed as

$$\Delta TFP = \Delta Y - \Delta X$$

Pacific Economics Group, LLC
Economic and Litigation Consulting

X Factor Options (Con't)



Output quantity a weighted average of:

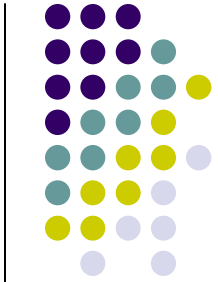
- Customer Numbers
- kWh deliveries
- kW demand (if available and accurate)

Revenue shares should be used to weight output quantity subindexes but are often unavailable

Cost elasticity shares are a second best, feasible alternative for output weights

Pacific Economics Group, LLC
Economic and Litigation Consulting

X Factor Options (Con't)



Input quantity a weighted average of:

- Labor inputs (if available)
- Other OM&A inputs
- Capital inputs

Changes in input quantity measured as changes in expenditure on the input minus the change in the associated input price subindex

>> input price indices constructed at same time as TFP indexes

Pacific Economics Group, LLC
Economic and Litigation Consulting

X Factor Options (Con't)

Index-based approaches to TFP measurement

Pros

- Relatively simple
- Requires less cross sectional data
- Relies on well established techniques
- Relatively well understood and transparent

Cons

- May not reflect diversity among distributors
- Will not necessarily yield reliable estimates of future TFP trends if business conditions in future differ from the past
- Requires relatively extensive time series data, usually at least 10 years
  - >> may not be feasible in Ontario

Pacific Economics Group, LLC
Economic and Litigation Consulting

X Factor Options (Con't)

Econometric techniques can also be used to decompose TFP growth into its various components

- Time trend/technological change
- Realization of economies of scale
- Changes in business conditions
- Changes in customer density
  - Changes in undergrounding
  - System age and investment requirements
  - Changes in the efficiency of operations

Estimated impact of various "TFP drivers" can be used to project TFP growth going forward given estimates of expected changes in business conditions

X Factor Options (Con't)

Econometric model for TFP projection will relate dependent variable to independent "driver" variables

Dependent variable: Total electricity distribution cost (capital cost + OM&A)

Possible Independent variables:

Input prices — Price labor; Price capital inputs

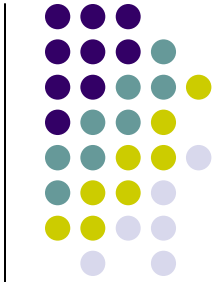
Outputs — Customer numbers; kWh deliveries

Other business conditions

- Distribution line miles
- Forestation
- System age
- % deliveries res. & commercial
- % Plant underground
- Combination utility
- Non-contiguous territory
- Retail competition

Pacific Economics Group, LLC
Economic and Litigation Consulting

X Factor Options (Con't)



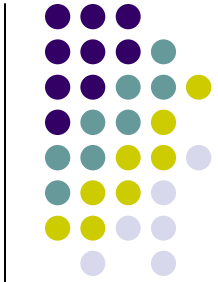
Econometric techniques would estimate the impact of the independent "driver" variables on distribution cost

The estimated econometric model can then be combined with data on the *changes* in business condition variables for a given firm, or group of firms, to estimate changes in cost and TFP that are associated with that firm's, or group of firms, particular TFP drivers

>>> will generate different TFP projections for firms with different changes in business condition/"driver" variables

Pacific Economics Group, LLC
Economic and Litigation Consulting

X Factor Options (Con't)



Econometric approaches to TFP measurement

Pros

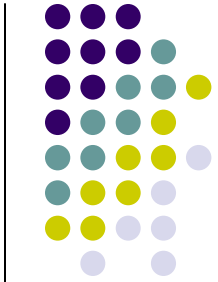
- Can reflect diversity in distributor business conditions
- Can capture differences in future business conditions compared with past
- Does not require as extensive time series data

Cons

- More complex
- More cross sectional data typically required
- Techniques and results less well understood

Pacific Economics Group, LLC
Economic and Litigation Consulting

X Factor Options (Con't)



Econometric method preferred approach for estimating X factors because it is better able to reflect distributor diversity

PEG has estimated rigorous cost function for electricity distributors using US Data

This model can be feasibly implemented in IRM3

Two main data issues in Ontario: Capital data
Available time series

>>> Ontario data could be added to the US sample and model re-estimated

Pacific Economics Group, LLC
Economic and Litigation Consulting

ECONOMETRIC COST MODEL FOR POWER DISTRIBUTION

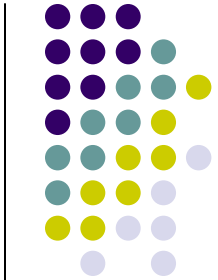
VARIABLE KEY

L = Labor Price
K = Capital Price
N = Number Customers
V = Total Throughput
M = Distribution Line Miles
OH = % Plant Overhead
NG = Number of Gas Customers
TF = % Territory Forested
Nadd20 = Twenty Year Customer Growth
VRC = % Deliveries Residential and Commerical
NC = Non-Contiguous Service Territory
TXGX = O&M Expenses for Transmission and Generation
CD= Competiton Dummy

EXPLANATORY VARIABLE	PARAMETER ESTIMATE	T-STATISTIC	EXPLANATORY VARIABLE	PARAMETER ESTIMATE	T-STATISTIC
WL	0.167	117.55	OH	-0.711	-13.46
LL	-0.074	-4.78	OHM	-0.337	-5.54
LK	0.006	0.53			
LN	0.019	3.66	NG	-0.007	-9.04
LV	-0.039	-9.04			
LM	0.002	0.60	Nadd20	-0.039	-2.81
WK	0.549	266.27	TF	0.064	12.25
KK	0.059	3.30	TFM	0.064	12.96
KN	-0.058	-8.68			
KV	0.092	15.11	VRC	0.281	8.31
KM	-0.017	-3.37			
			NC	0.012	5.76
N	0.410	15.77			
NN	0.730	7.05	TXGX	-0.020	-2.93
NV	-0.595	-6.24			
NM	-0.142	-2.43	CD	0.005	2.50
V	0.406	19.05	Trend	-0.017	-16.56
VV	1.009	11.22			
VM	-0.368	-7.83	Constant	19.290	1217.52
M	0.199	12.11			
MM	0.461	7.54	System Rbar-Squared	0.985	
			Number of Obsevations	979	

Pacific Economics Group, LLC
Economic and Litigation Consulting

X Factor Options (Con't)



An econometric model would be used to project TFP growth and develop X factors for defined "cohorts" of distributors

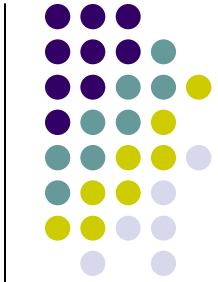
This approach designed to accommodate diversity among distributors in the Province

Important implementation issues

- What is an appropriate number of X factors?
- How to determine relevant "cohorts"?

Pacific Economics Group, LLC
Economic and Litigation Consulting

X Factor Options (Con't)



A cohort approach more reasonable for IRM3 than individual company X-factors

>>> differences in data quality among distributors could distort TFP projections and lead to less rather than more precise X factors

Definition of cohorts would build on PEG's electricity distribution benchmarking work

Would determine peers primarily based on *changes* in business conditions, such as changes in customer numbers

>> different drivers for TFP *growth* rather than differences in cost levels (differences in cost levels would already be embedded in base rates)

Pacific Economics Group, LLC
Economic and Litigation Consulting

X Factor Options (Con't)

X-factors may also contain "stretch factor" aka "consumer dividend"

Basic Idea: Set X above industry TFP trend as benefit-sharing mechanism

In principle, value of consumer dividend can differ among companies to reflect differences in efficiency at outset of PBR plan and hence potential for TFP gains under the plan

Next Steps

Stakeholder feedback

Finalize details of inflation factor

Refine econometric model for TFP projections

Define cohorts

Finalize TFP projections/X factor projections for cohorts

PEG report targeted for release with staff discussion paper end of January, 2008.

Pacific Economics Group, LLC
Economic and Litigation Consulting