3G IRM consultation (EB-2007-0673):
X factor specification, inflation index selection, and capital expenditure issues

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on behalf of the Coalition of Large Distributors (CLD) and Hydro One Networks Inc. (HONI)

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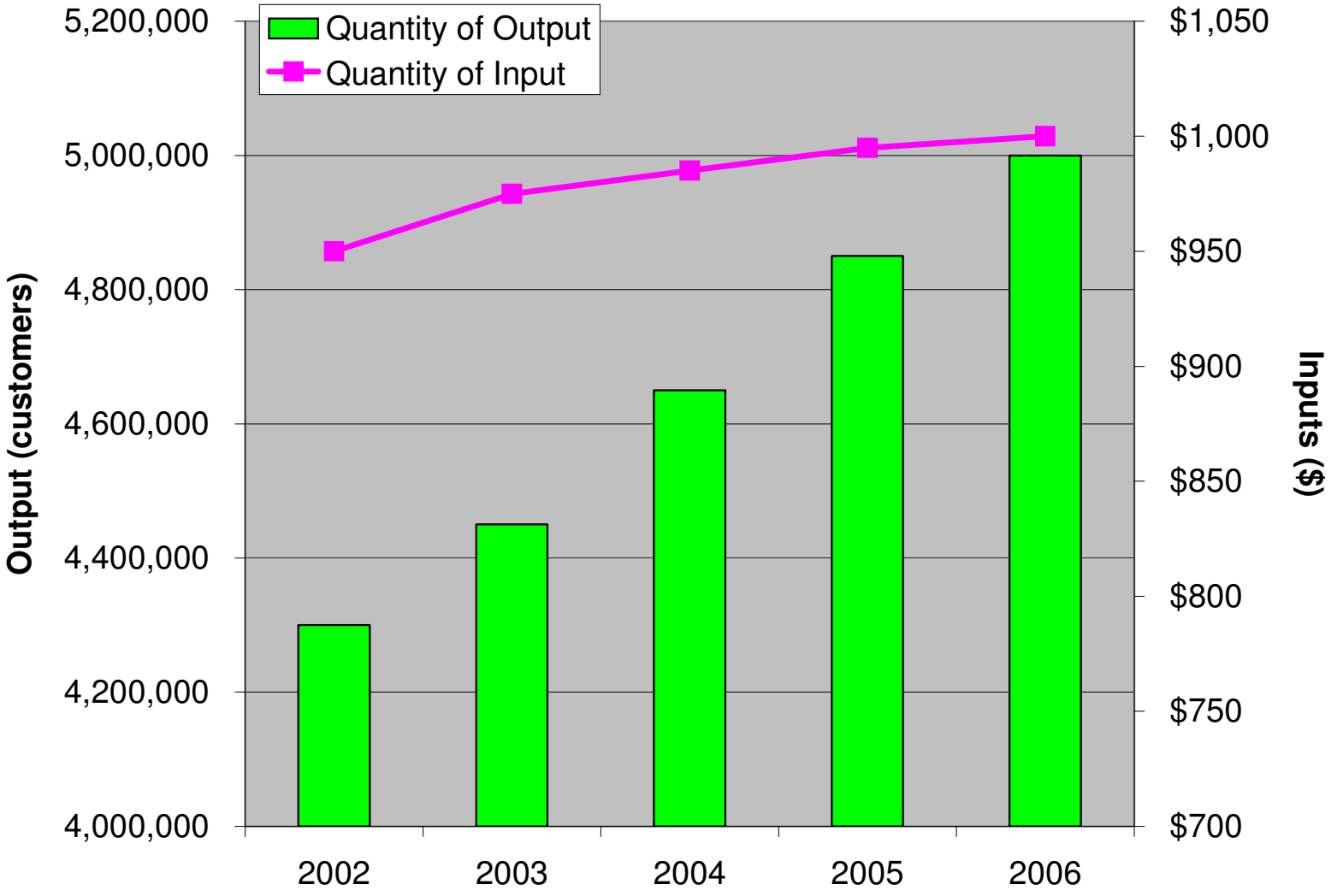
Key messages

- We accept PEG's overall approach for using index methods to measure trends in industry average productivity, *but*
  - methodology can be refined further with more comprehensive model specification and physical capital measures
  - focus should be on recent (2002-2006) Ontario trends
  - as data improves over time, X factor should also reflect diversity across firms through robust measures of relative productivity
- A customized industry-specific input price index would be superior choice, *if*
  - appropriate and reliable sub-indices for all major costs existed
  - cost shares were stable
  - volatility adjustments did not impede the recovery of cost changes
- Capital expenditure module needs to be part of the "core" plan – rather than a Z-factor like mechanism - in order to ensure the Board's primary principles of financial viability, sustainability, and stability of rates

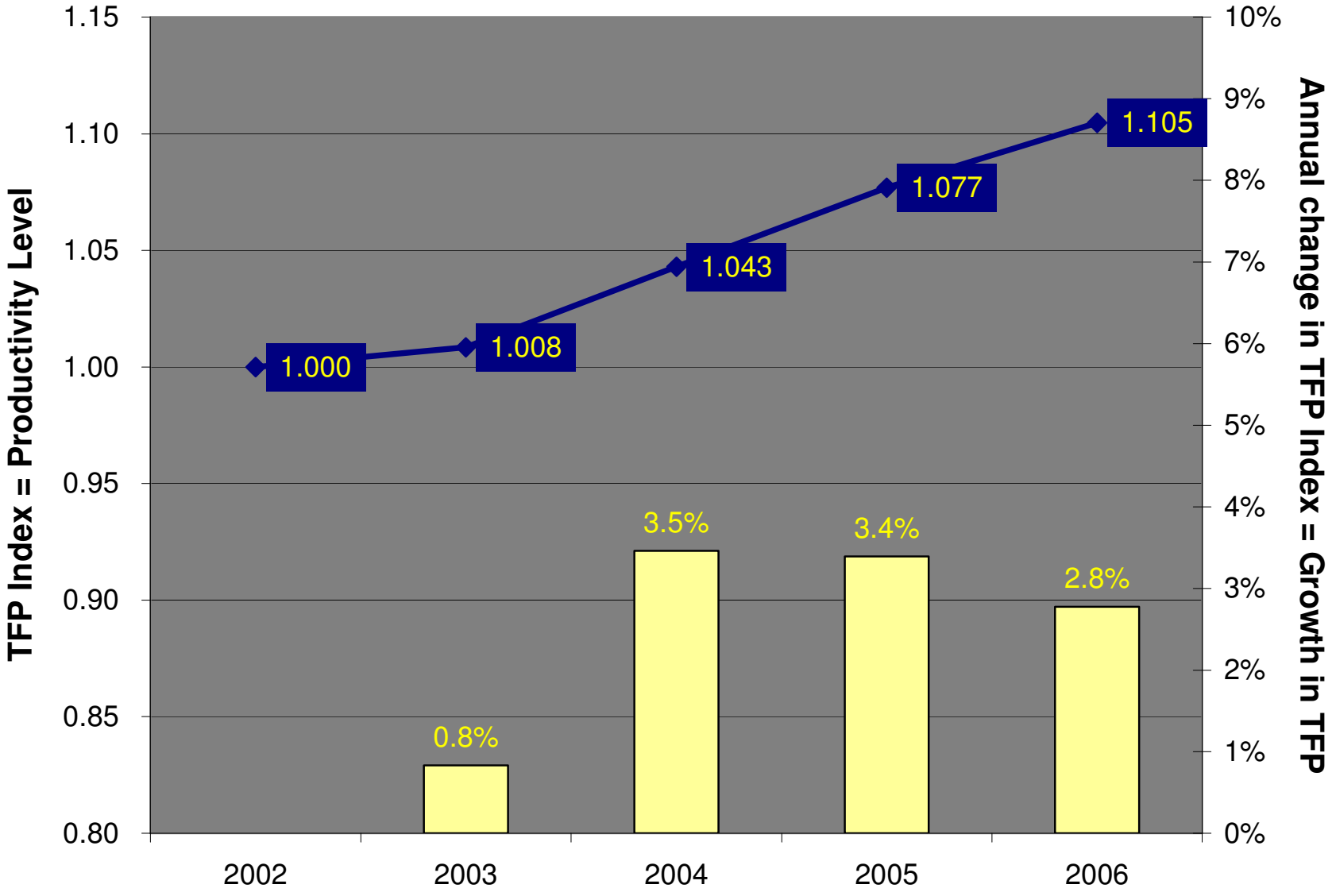
Productivity Factor

Total factor productivity is the appropriate productivity measure under a comprehensive price cap



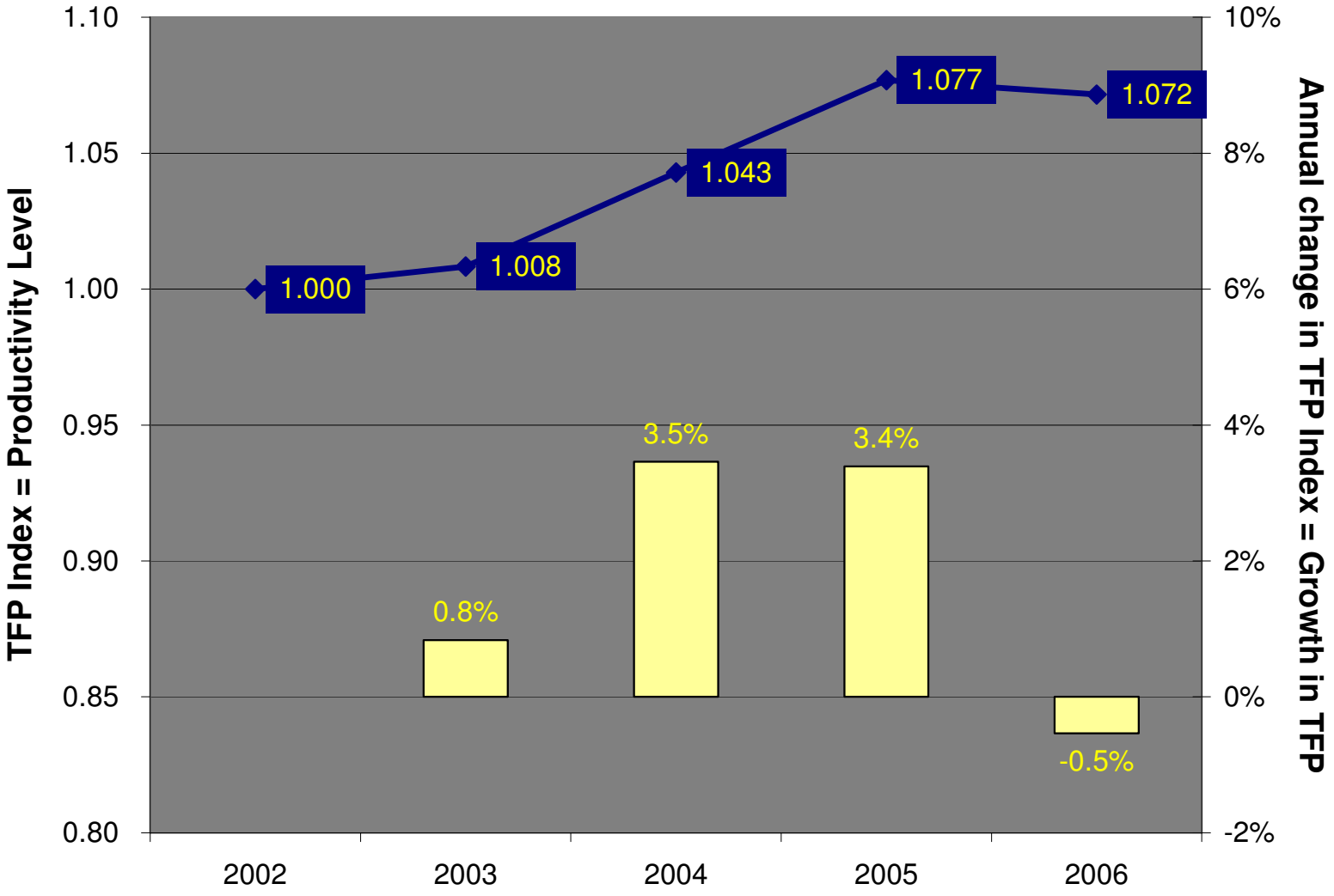
Illustrative data

Productivity growth is represented by the change in TFP levels year-to-year



Illustrative data

Negative growth rates are plausible under common business cycle conditions



Illustrative data

We agree with PEG's proposal to use index method for calculating industry average TFP growth - it is a transparent and robust approach

- Index number theory has been developed extensively over the years, yielding index approaches like Fisher Ideal, which possess all the right theoretical properties
- Index method is well recognized technique for productivity analysis - employs directly the "raw" data on inputs and outputs

Step-by-step Process for TFP Analysis

1. Select output measures for the industry – typically, physical measures of quantity
2. Determine how to aggregate (average) these outputs – revenue or cost shares
3. Select input measures: OM&A can be measured from income statement, capital input can be measured via direct method (physical asset approach) or indirect method (deflated asset values)
4. Determine implicit input price indices to isolate the quantity of inputs
5. Calculate input and output quantity indices, calibrated to same start year
6. Combine input and output quantity indices into a TFP measure - assess trend in TFP

Sufficient Ontario industry aggregate data exists to do an analysis of TFP, 2002-2006

Year	Throughput	Customer numbers	Peak demand
	kWh		*kW*
2002	113,257,605,034	4,303,716	27,803,678
2003	115,506,338,511	4,388,660	26,666,631
2004	116,695,981,455	4,460,842	25,464,011
2005	122,179,877,250	4,533,426	22,765,502
2006	119,082,477,315	4,592,124	23,996,250

Given the available data, three output measures employed: throughput (to represent volumes delivered), customer numbers (to proxy number of connections), and peak demand (to proxy system carrying capacity)

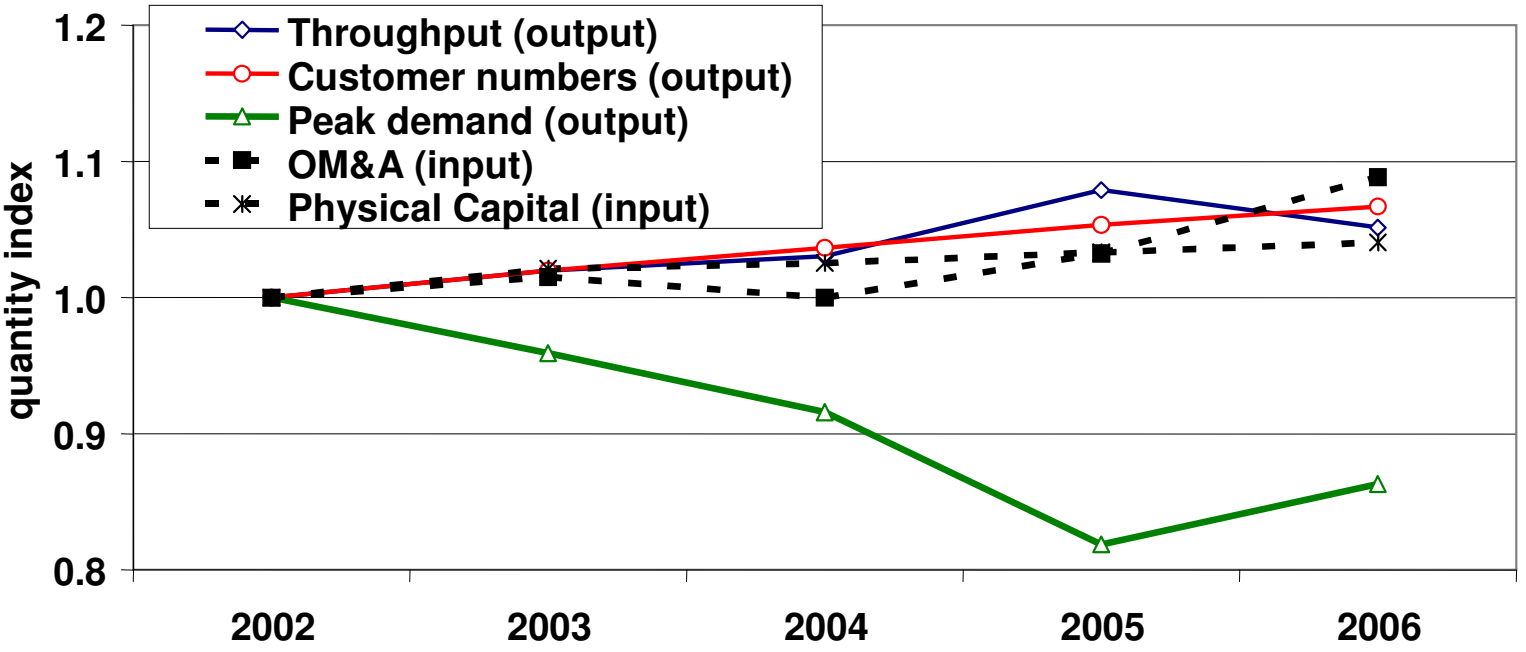
Year	OM&A Costs	OM&A Implicit Price index
	$ mio	
2002	975.32	1.000
2003	1,006.75	1.017
2004	996.34	1.022
2005	1,041.54	1.034
2006	1,121.84	1.057

OM&A Cost data taken directly from reported utility data and then divided by Implicit OM&A Price Index composed of both a labor price index (average weekly earnings for Canadian utilities) and materials index (GDP implicit price index) to get an OM&A Quantity Index

Year	Total line length	Total Billed Distribution Revenues	OM&A Costs	Capital Costs = Capital Implicit Price Index
	km	*$ mio*	*$ mio*	*$ mio*
2002	193,974	2,508.45	975.32	1,533.14
2003	198,073	2,099.65	1,006.75	1,092.91
2004	198,870	2,097.80	996.34	1,101.46
2005	200,424	2,282.71	1,041.54	1,241.17
2006	201,837	2,408.98	1,121.84	1,287.13

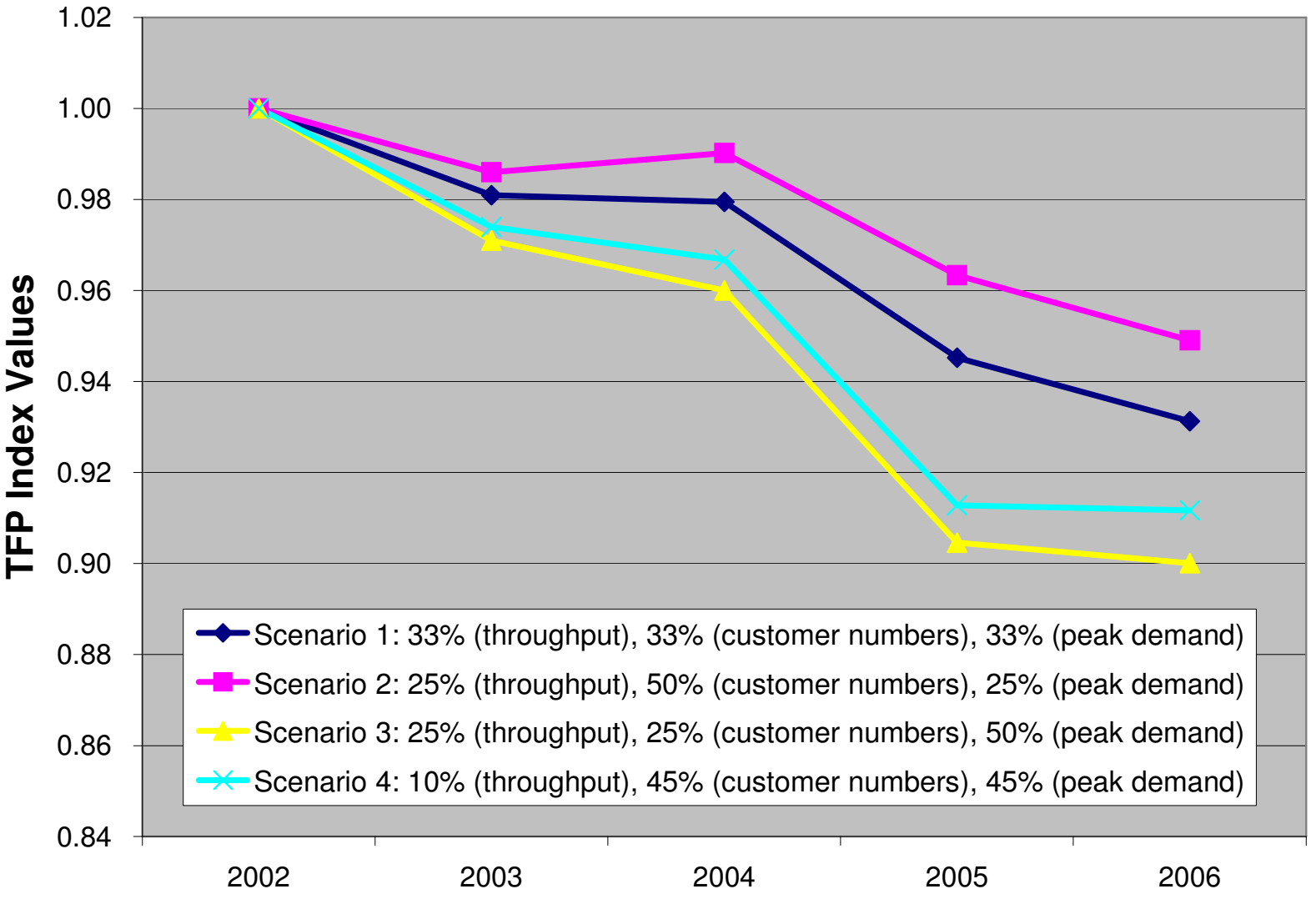
Direct method – based on observed physical units of capital employed, which captures actual physical depreciation trends. Physical units of distribution line are then normalized by the implicit capital price index, which is calculated using the the endogenous capital pricing method: total revenues less OM&A

Quantity indices for inputs and outputs are good indicators of TFP trends



Year	Throughput (output)		Customer numbers (output)		Peak demand (output)		OM&A Quantity (input)		Capital Quantity (input)	
2002	1.000		1.000		1.000		1.000		1.000	
2003	1.020	*2.0%*	1.020	*2.0%*	0.959	*-4.1%*	1.015	*1.5%*	1.021	*2.1%*
2004	1.030	*1.1%*	1.037	*1.7%*	0.916	*-4.3%*	1.000	*-1.5%*	1.025	*0.4%*
2005	1.079	*4.8%*	1.053	*1.7%*	0.819	*-9.7%*	1.032	*3.2%*	1.033	*0.8%*
2006	1.051	*-2.7%*	1.067	*1.4%*	0.863	*4.4%*	1.088	*5.6%*	1.041	*0.7%*
Trend 2002-2006		**5%**		**7%**		**-14%**		**9%**		**4%**

Over a range of potential output weights, trend in TFP in Ontario is estimated to be negative



We estimate a lower TFP growth trend for Ontario primarily because of a more comprehensive set of outputs and use of direct capital method

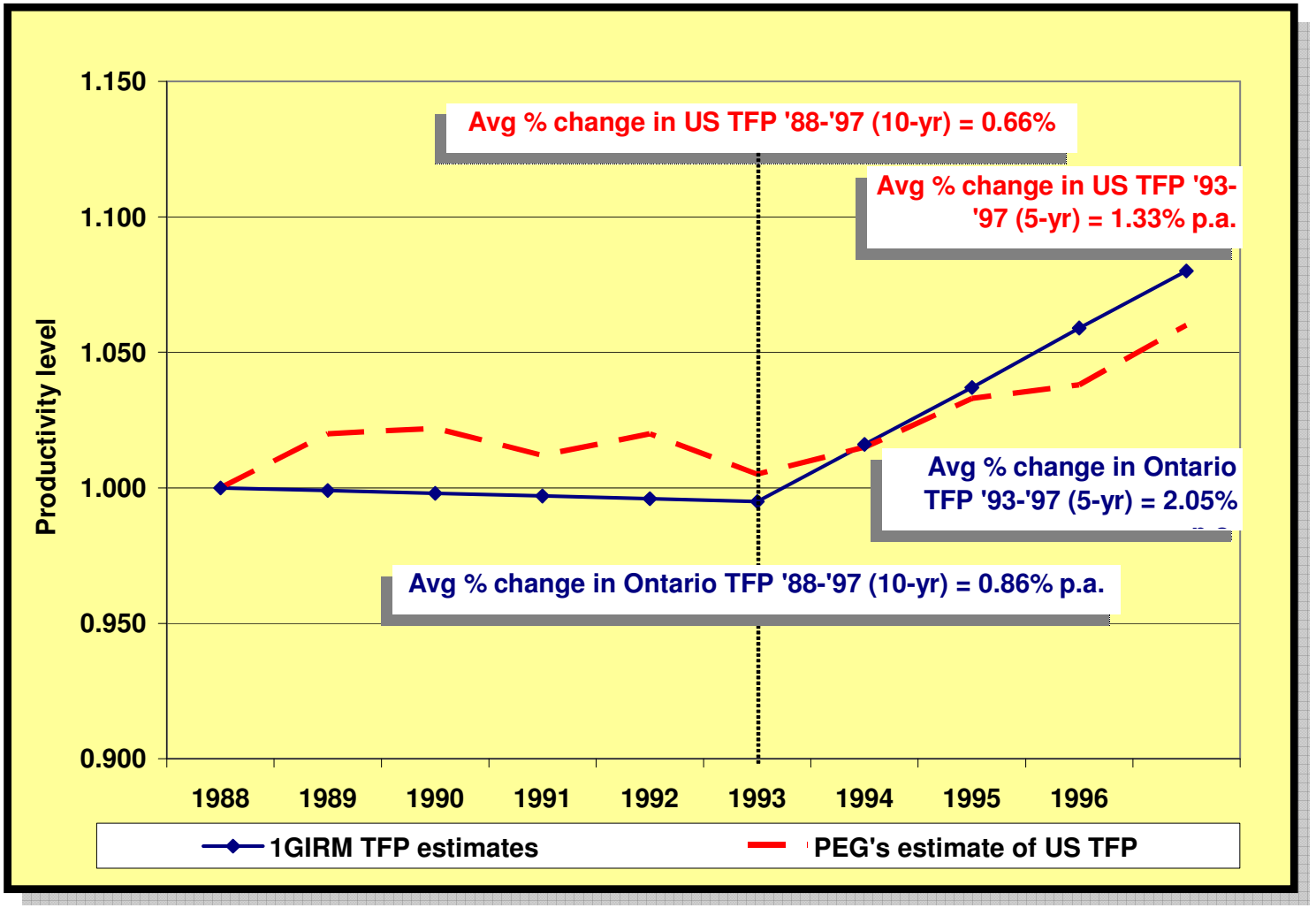
- We have not had access to PEG's data, but we understand that they used a two output model – which will overstate TFP growth given the trends in peak demand. If we ignore peak demand as an output (and use PEG's output cost shares (63% for customer number and 37% for throughput)), bias is confirmed

Test (without Peak Demand; PEG weights)				
Year	Output index	Input index	TFP index	% Change
2002	1.000	1.000	1.000	
2003	1.020	1.019	1.001	**0.12%**
2004	1.034	1.013	1.021	**1.93%**
2005	1.063	1.033	1.029	**0.84%**
2006	1.061	1.062	0.999	**-3.00%**
			average	**-0.02%**

- PEG has also employed deflated asset value approach for measuring capital input. This approach does not provide a good proxy for annual capital input quantities in the electricity distribution industry.
- In addition, there are differences in the OM&A Index which we have not been able to reconcile. PEG has also excluded nine firms from sample.
- PEG weather normalizes throughput, which also has impact on output quantity index. For transparency, it is better to do the indexing without weather normalization.

In 1G IRM, Board recognized the importance of recent trends in setting the productivity factor

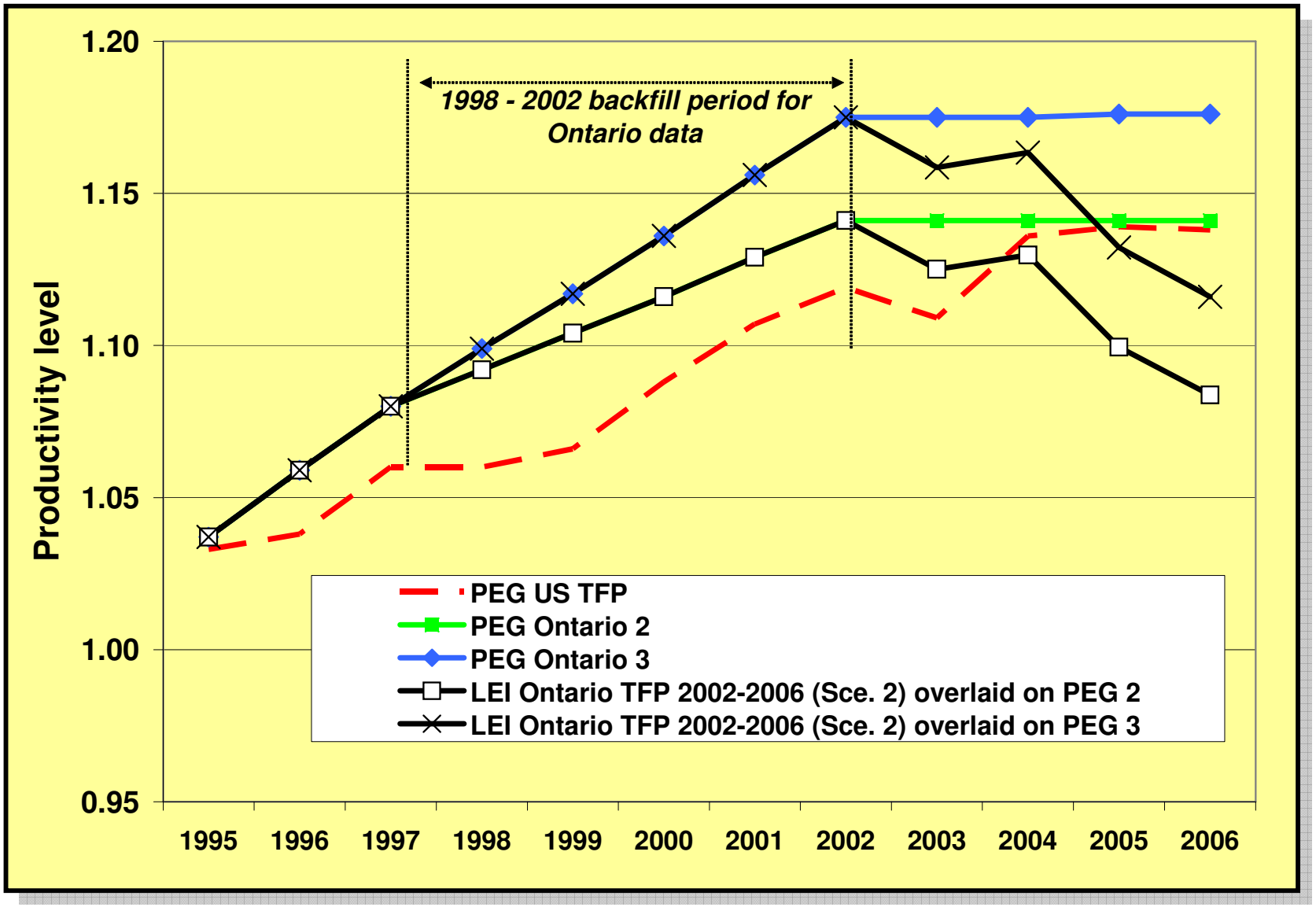
- Five year trends were higher than ten-year average, suggesting ramp up in productivity growth
- Final X factor of 1.25% put more weight on TFP growth in recent five years over the TFP growth over 10 years
- US LDCs also exhibited similar ramp up in productivity



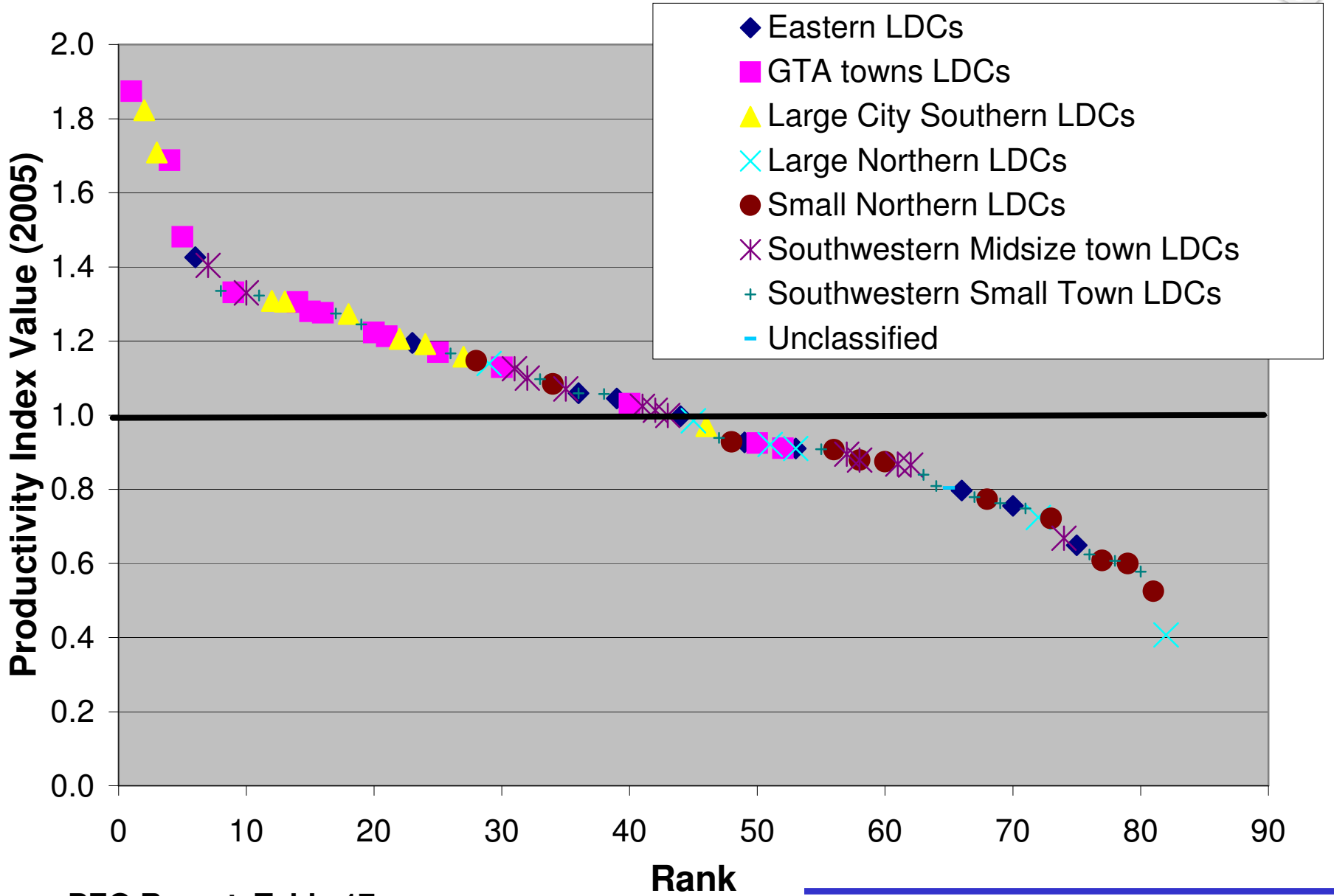
Recent trends should again be considered in the determination process: an 0.88% annual X factor is too high

- Any reasonable analysis should logically recognize that **productivity growth rates will decline with time as inefficiencies are removed**
- According to PEG's own analysis, US TFP showing slowdown; and, under 'back-filled' scenarios, Ontario TFP growth also declining
  - US: annual growth of 0.89% (1995-2006) down to 0.41% (2002-2006)
  - Ontario: 0.88% to 1.15% estimates of annual TFP growth (1995-2006) down to 0.01% (2002-2006)
- Even <u>without weighting</u>, but simply correcting biases in PEG's analysis that overstate TFP growth in 2002-2006 period, highest calibrated X factor for 1995-2006 period would be in the range **<u>0.41% p.a. to 0.68% p.a.</u>**

Deceleration of TFP growth: US and Ontario



Available OM&A productivity measures suggest very significant diversity among OEB staff peer groups

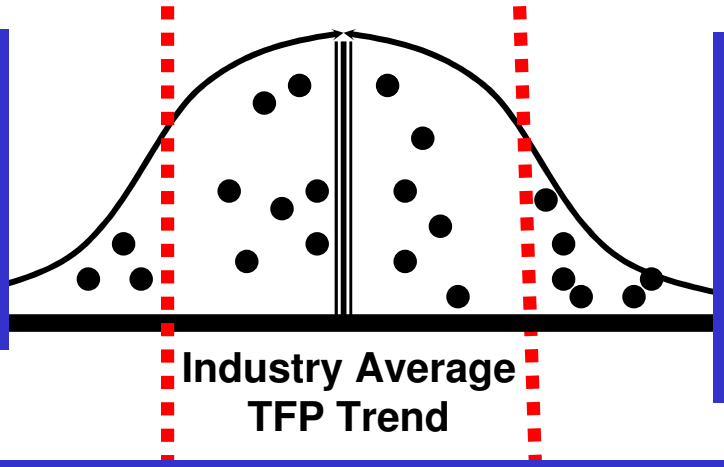


Source: PEG Report. Table 17.

Ideally, diversity of firms should be reflected in the final productivity target in order to better motivate efficiency

- Diversity in productivity results in different levels and growth rates – some firms exhibit average productivity, while others are superior performers and still others are inferior performers

Inferior performers should receive a positive stretch factor to encourage them to catch up to industry average trends



Superior performers should receive a negative stretch factor to reflect their current productivity level vis-à-vis the industry average and reduced ability to maintain faster paced growth

Average performers should receive a zero stretch factor to represent their relative position to the industry average TFP growth estimates

- Stretch factors that encourage convergence to industry average are most consistent with the Board's vision for an **efficiency-enhancing** and **sustainable** 3G IRM framework

A group or peer approach using multilateral TFP analysis would be most practical method for setting 'diversity factors'

- But peer classification created by Board staff insufficient – we cannot determine whether the productivity levels of firms within each peer group are consistent
- Analysis of distributor's efficiency has been limited to the OM&A costs to date – inadequate for analyzing TFP or setting rates for a comprehensive price cap
  - Physical capital data would need to be improved in order to allow for robust Multilateral TFP, so that we can compare the various types of capital (different voltage of lines, underground versus aerial, substations) on an apples-to-apples basis across LDCs.
  - MVA kilometer metric can achieve this by measuring the 'carrying capacity' of the network recognizing that the effective capacity of an individual line depends not only on the voltage of the line but also on a range of other factors, including the number, material and size of conductors used, the allowable temperature rise as well as limits through stability or voltage drop.

Inflation Factor

There are two basic choices for inflation index and both have precedent in Ontario

Macroeconomic Price Index

- CPI (Consumer Price Index), GDP-IPI (GDP Deflator)
- Pros: readily available; transparent and well-understood; well-developed by statistical agencies; stable
- Cons: does not specifically track actual industry cost trends; if employed, X factor should be adjusted for economy-wide TFP growth and Input Price Differential (IPD)
- *Precedent: 2GIRM, Gas IRM*

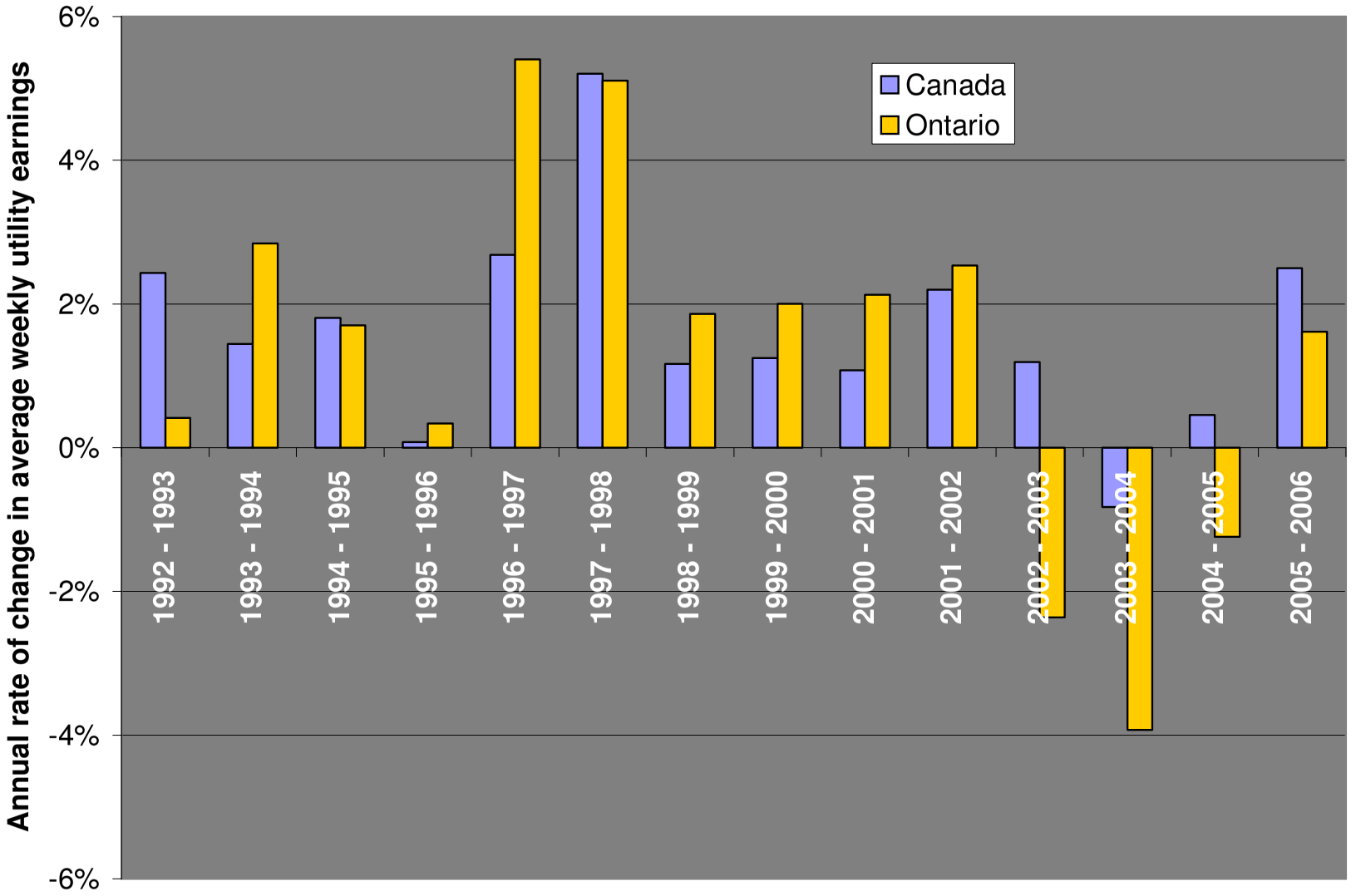
Industry Input Price Index (IPI)

- Customized index, containing sub-indices of relevant costs – capital, labor, materials
- Pros: tracks actual input costs for industry, and therefore unlikely to over- or under-compensate; avoids IPDs
- Cons: requires compilation of indices that reflect change in all production costs, proxy indices likely to be less liquid, less robust, and more volatile
- *Precedent: 1GIRM*

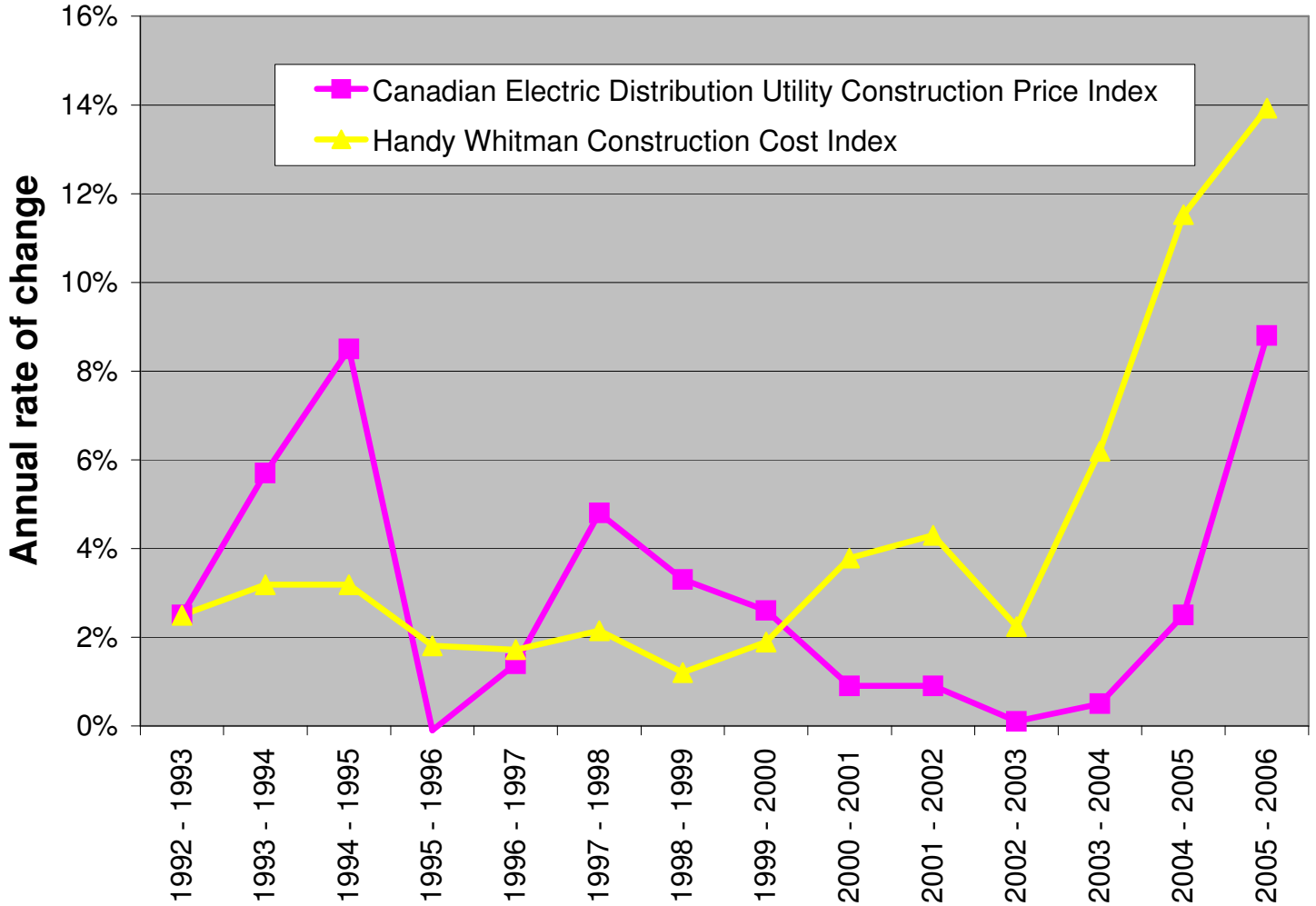
Input price index (IPI) conceptually the better option but practical concerns remain

- Public indices available from *Statistics Canada* on labor costs, utility capital costs, and some proxies available for materials costs. Have these indices been checked for reasonableness and consistency with actual cost trends? Are other indices better proxies?
- Individual sub-indices for labor, capital, and materials are combined using constant weights (cost shares) into an IPI – but is it reasonable to assume cost shares will stay constant at historic levels when the goal of IRM is to motivate the most efficient input allocation
- Stable and predictable rates are important for customers as well as the LDCs.
  - Backcast analysis shows year-on-year changes of over 3% (up or down) for 50% of the years, 1992-2006
  - But smoothing can compromise the underlying objective of an IPI

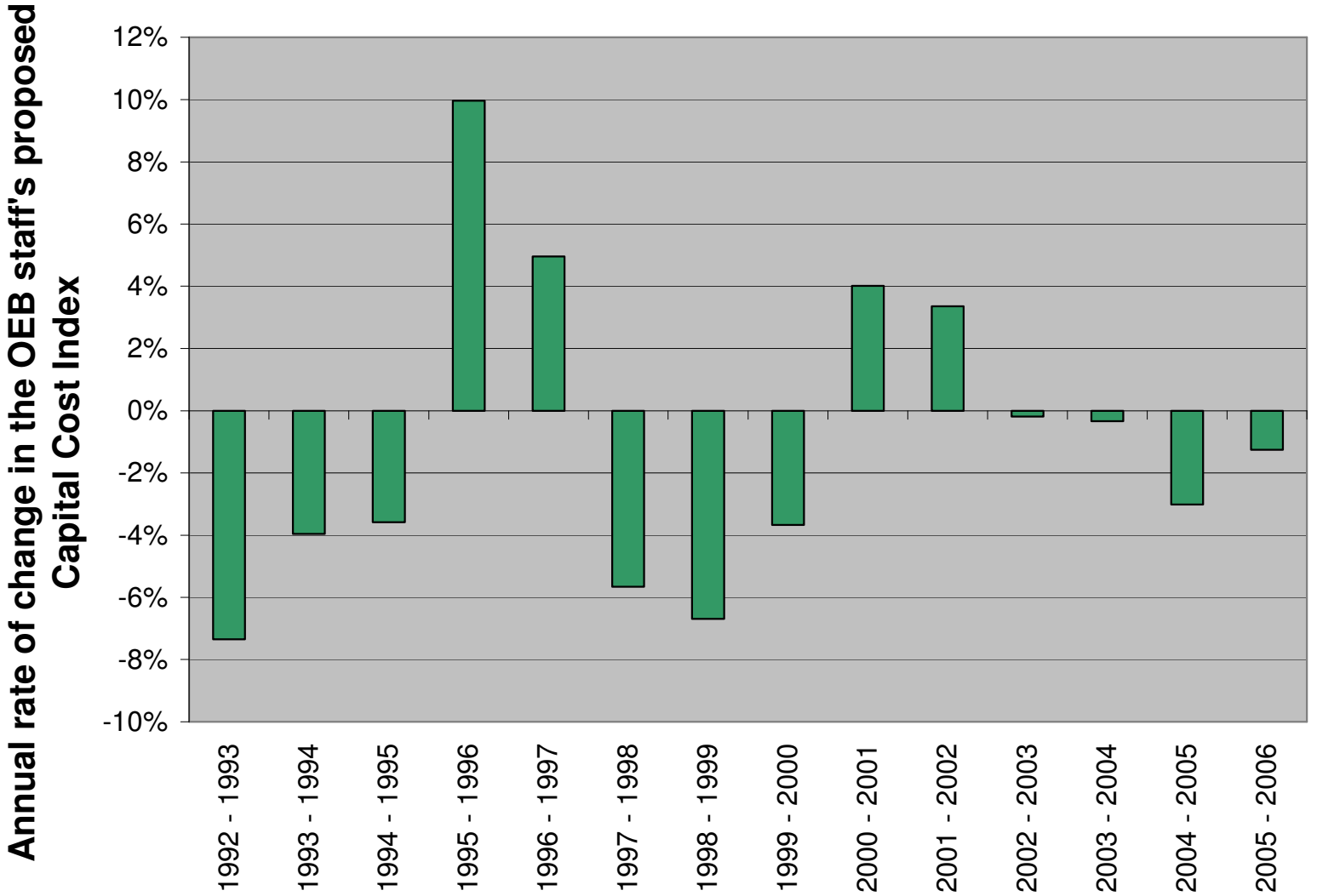
Have Ontario utility wage rates declined three years in a row?



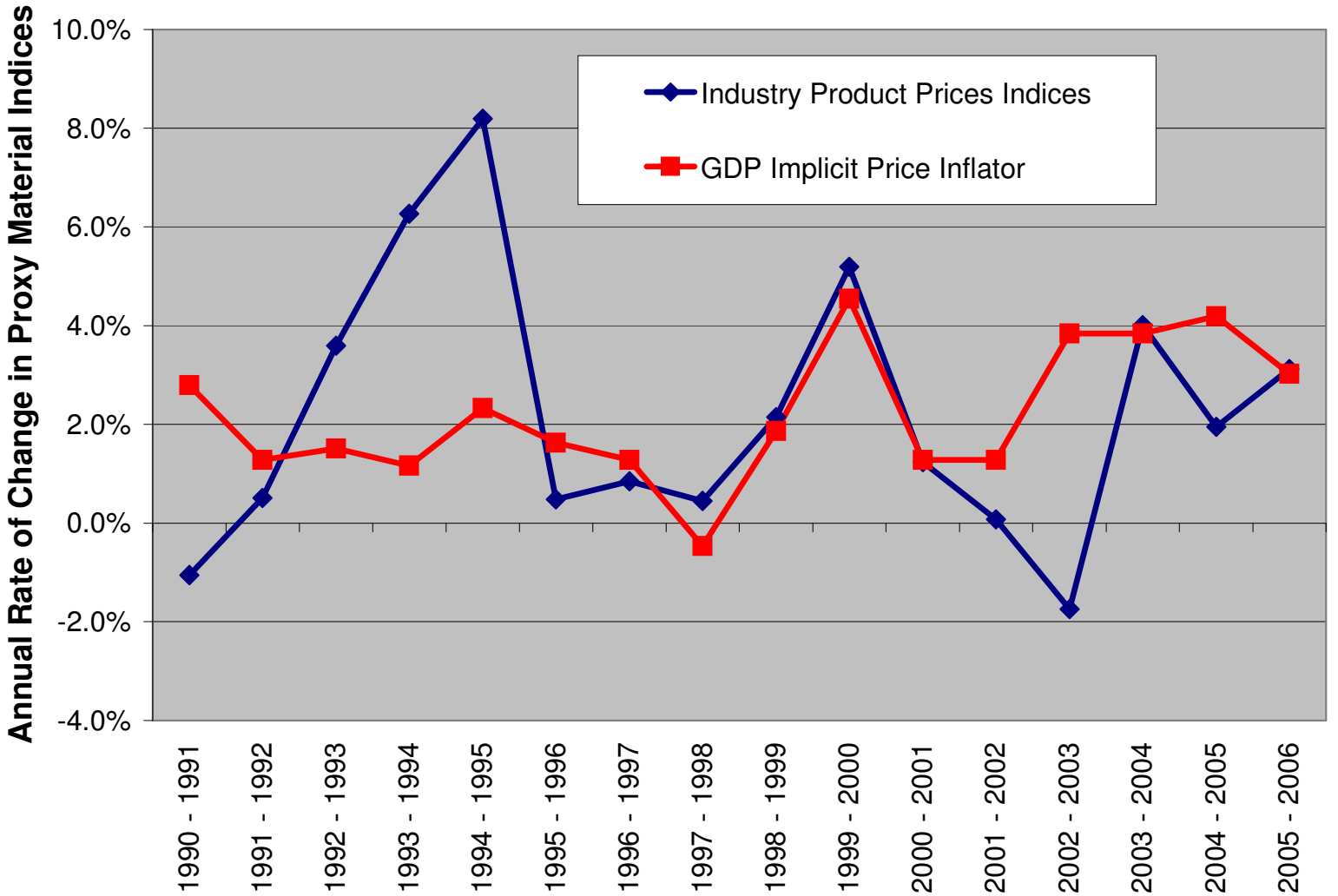
Why has Canadian utility construction costs been more muted than US trends?



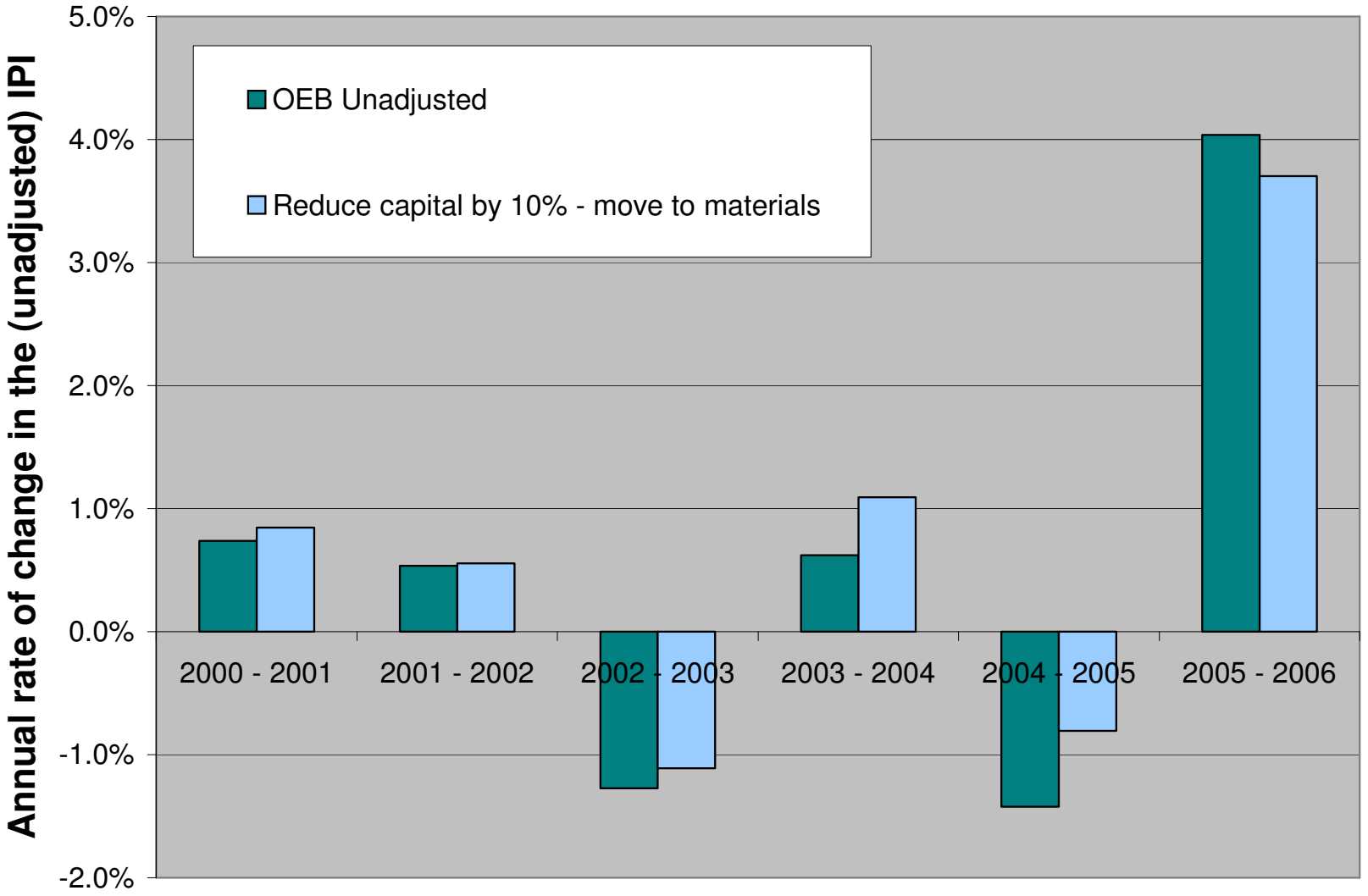
Because of the bond rate trends, all-in capital cost index is showing a declining trend – is this reasonable?



What would be a good proxy for 'materials' (intermediary services) cost trends?

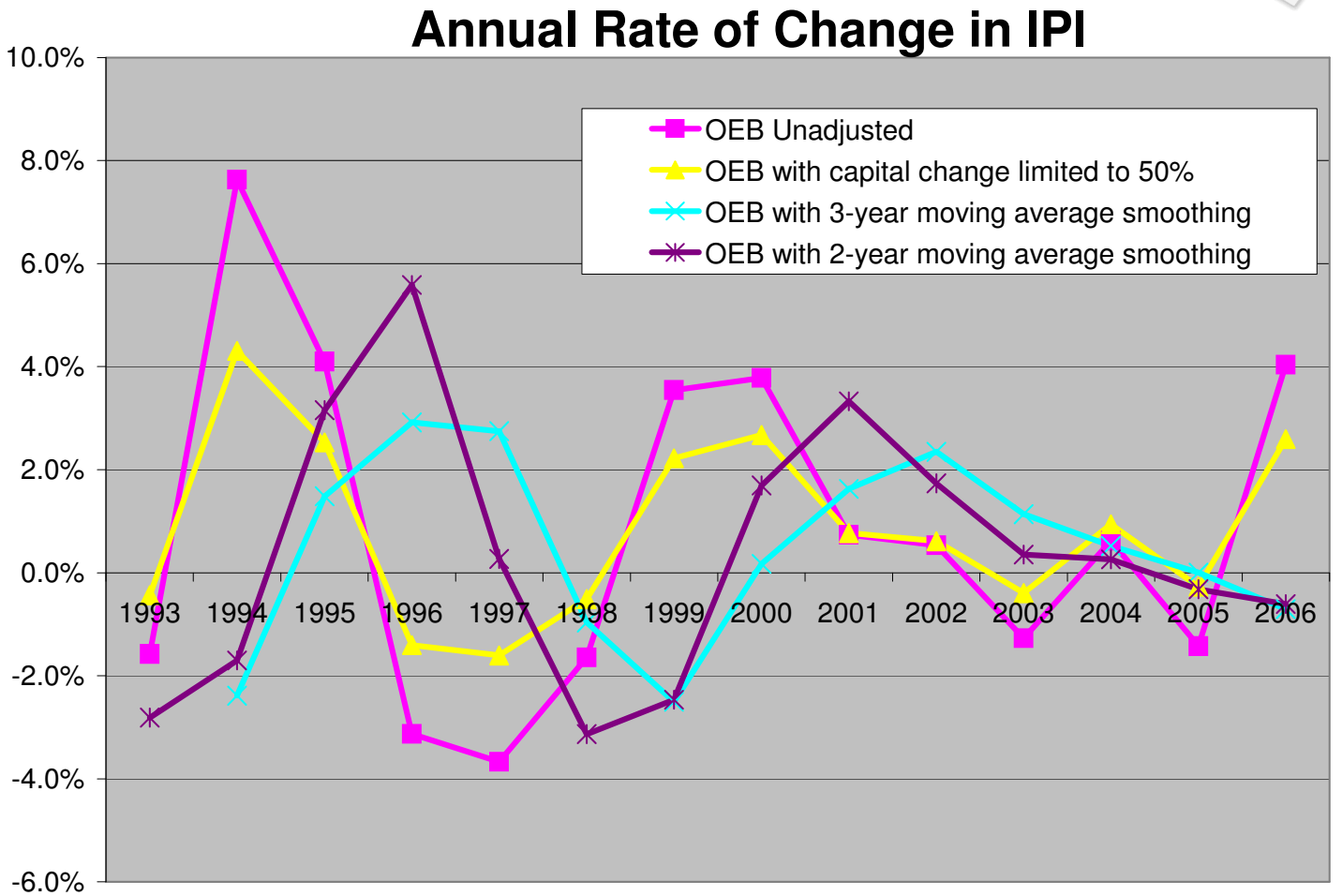


Even relatively small changes in cost shares can lead to discrepancies in cost recognition



Volatility adjustments, if pursued, need to recognize that not all capex is discretionary

- Use of the 50% factor in 1GIRM resulted in continued under-recovery of cost changes
- Moving average approach shifts timing of recovery for capex element



If smoothing is pursued by the Board, we propose that as short as possible Moving Average factor be applied and/or only a portion of the capital index exposed to smoothing

At the same time, use of a macroeconomic indicator would also face some practical challenges

- Macroeconomic output-based indicators represent not only changes in price but also the impact of average productivity improvements across the economic sectors
- In order to properly account for the trend in utility unit cost, price cap needs to then include an Input Price Differential and Productivity Differential:
  - Price Cap Rate of Change = IPI – TFP or
  - Price Cap Rate of Change = (GDPIPI + IPD) – (TFP-$TFP_{economy}$)
  - IPDs are difficult and controversial to estimate; in many other jurisdictions, IPD conservatively assumed to be equal to 0
- *Statistics Canada* publishes a TFP measure for the business sector only – a multifactor productivity - this is probably the best available proxy for historical $TFP_{economy}$ (consistent with what was used in other jurisdictions)

Capital Expenditure Module

A capex module is necessary for various reasons: financial sustainability, predictability

- Only in a 'steady state' environment and during specific business cycles, can utilities be expected to rely simply on efficiency gains in operating costs to finance capital improvements
- Multi-purpose module that accommodates different capital uses
  - "Incremental capex" not practical concept in Ontario setting given historical cost accounting and how capital programs are designed and administered
  - Capex module most useful for predictable large scale capital programs – asset replacement, growth, policy mandates - rather than for funding extraordinary events
- Diversity across LDCs in how capital is employed and what is "capitalized"
  - LDCs would show that they need a capex module on top of the basic price cap by submitting a pro forma financial model

A number of options reviewed in working group for capex – K factor has most appeal

- K factor would be an additional (modular) term of the comprehensive price cap based on differences in revenue requirement associated with capital expenditure in excess of amortization
  - K factor rate linked to volume growth or aging, or (preferably) to projected multi-year capital spending (with prudence review)
  - Thresholds for activation of the K factor need to recognize spending by program rather than 'individual driver'
  - Some precedent in other jurisdictions for an explicit K factor (I-X+K) as well as embedded K-like adjustments to X factor to capital pressures on revenues (I+X).
- K factor greatly improves the price cap regime
  - Ensures financial viability (allowed rate of return, sustainable funding regime for capex)
  - Rate predictability (for customers, and utility planners)
  - Stability and long term applicability of 3GIRM design in the face of various stages of investment by firm and across industry

Simple financial analysis highlights the need for a capex module despite growth and improving productivity

Ratebase fixed at 50% of forward test year capex

35% implied tax rate

	Distribution Rates	Volume Served	Revenues	Rate Base	OM&A Expenses	Amortization of capital invested	Interest expense	Payment in lieu of taxes	Net Income	Return on Equity
	$/MWh	*MWh*	*$ millions*	*$ millions*	*$ millions*	*$ millions*	*$ millions*	*$ millions*	*$ millions*	
Base Year (T)	$ 17.50	6,750,000	$ 118.1	$ 575.0	$ 40.0	$ 26.2	$ 21.4	$ 10.7	$ 19.9	8.5%
T+1	$ 17.59	6,817,500	$ 119.9	$ 597.5	$ 40.2	$ 29.3	$ 22.0	$ 9.9	$ 18.4	7.7%
T+2	$ 17.68	6,885,675	$ 121.7	$ 597.5	$ 40.4	$ 32.5	$ 22.5	$ 9.2	$ 17.1	6.9%
T+3	$ 17.76	6,954,532	$ 123.5	$ 597.5	$ 40.6	$ 35.6	$ 22.9	$ 8.5	$ 15.9	6.3%
T+4	$ 17.85	7,024,077	$ 125.4	$ 597.5	$ 40.8	$ 38.8	$ 23.2	$ 7.9	$ 14.7	5.8%
T+5	$ 17.94	7,094,318	$ 127.3	$ 597.5	$ 41.0	$ 41.9	$ 23.4	$ 7.3	$ 13.6	5.3%

Rate growth based on price cap formula.
I = 1.0%
X = 0.5%

Annual load growth of 1%

Real cost reductions in O&MA, before inflation, of 0.5% - keeping pacing with the X factor

Amortization and interest expense on ratebase plus capex of $45 million per year with 60% leverage and 6.1% interest

ROE declining quickly below allowed ROE despite efficiency gains

Cost gains need to be nearly 30% from base year to maintain ROE at allowed rate of return

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Cost reductions from Base Year (% and $ millions)			
X Factor	**0.25%**	26.0%	$10.4
	0.50%	30.0%	$12.0
	0.75%	34.0%	$13.6
	1.00%	37.0%	$14.8
	1.25%	41.0%	$16.4
	1.50%	44.0%	$17.6

And seemingly 'small' changes in X factor create substantial pressures on financial viability – a 100 basis points increase in X factor would require 44% reduction in OM&A to achieve allowed rate of return

Concluding remarks

- Given the evidence, any reasonable analysis should logically recognize that productivity growth rates are declining – an X factor based on any other paradigm would not be sustainable
  - We recommend an industry-wide X factor in the range of 0.4% to 0.7% for 3G IRM
  - Current data is inadequate at robustly quantifying firm-level or peer group stretch factors – Board needs to work with industry and commit to developing more accurate and extensive data set for analysis of diversity among firms
- A customized industry-specific input price index would be superior choice if practical design issues can be resolved
- Capital expenditure module needs to be part of the "core" plan in order to ensure the Board's primary principles of financial viability, sustainability, and stability of rates

Additional Background Information

Tabular results for historical TFP growth analysis using three output model with physical capital input quantities

Scenario 1: 33% (throughput), 33% (customer numbers), 33% (peak demand)

Year	Output index	Input index	TFP index	% Change
2002	1.000	1.000	1.000	
2003	0.999	1.019	0.981	**-1.9%**
2004	0.993	1.013	0.980	**-0.1%**
2005	0.976	1.033	0.945	**-3.4%**
2006	0.989	1.062	0.931	**-1.4%**
			average	**-1.7%**

Scenario 2: 25% (throughput), 50% (customer numbers), 25% (peak demand)

Year	Output index	Input index	TFP index	% Change
2002	1.000	1.000	1.000	
2003	1.004	1.019	0.986	**-1.4%**
2004	1.003	1.013	0.990	**0.4%**
2005	0.995	1.033	0.963	**-2.7%**
2006	1.008	1.062	0.949	**-1.4%**
			average	**-1.3%**

Scenario 3: 25% (throughput), 25% (customer numbers), 50% (peak demand)

Year	Output index	Input index	TFP index	% Change
2002	1.000	1.000	1.000	
2003	0.989	1.019	0.971	**-2.9%**
2004	0.973	1.013	0.960	**-1.1%**
2005	0.934	1.033	0.905	**-5.5%**
2006	0.956	1.062	0.900	**-0.5%**
			average	**-2.5%**

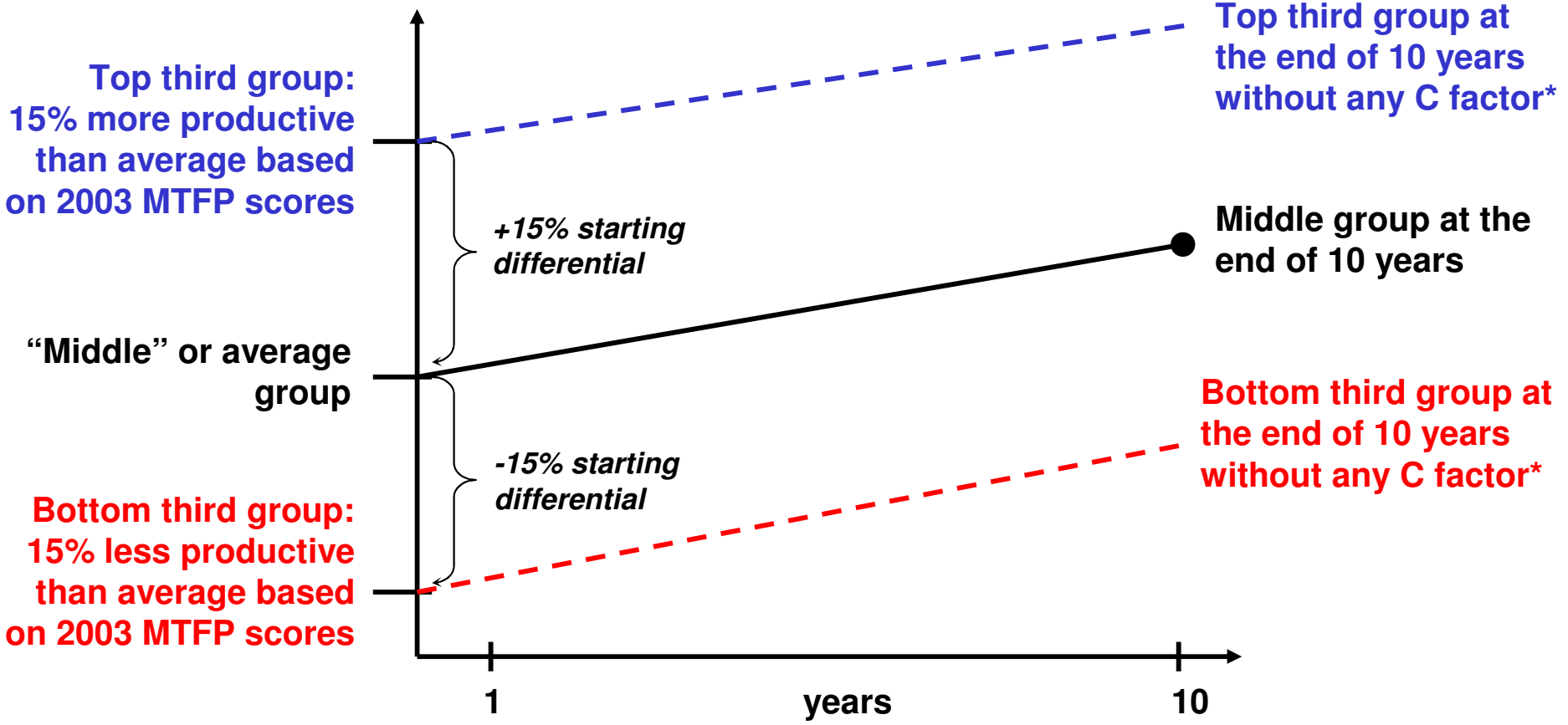
Scenario 4: 10% (throughput), 45% (customer numbers), 45% (peak demand)

Year	Output index	Input index	TFP index	% Change
2002	1.000	1.000	1.000	
2003	0.992	1.019	0.974	**-2.6%**
2004	0.980	1.013	0.967	**-0.7%**
2005	0.943	1.033	0.913	**-5.4%**
2006	0.968	1.062	0.912	**-0.1%**
			average	**-2.2%**

MTFP in practice: New Zealand approach

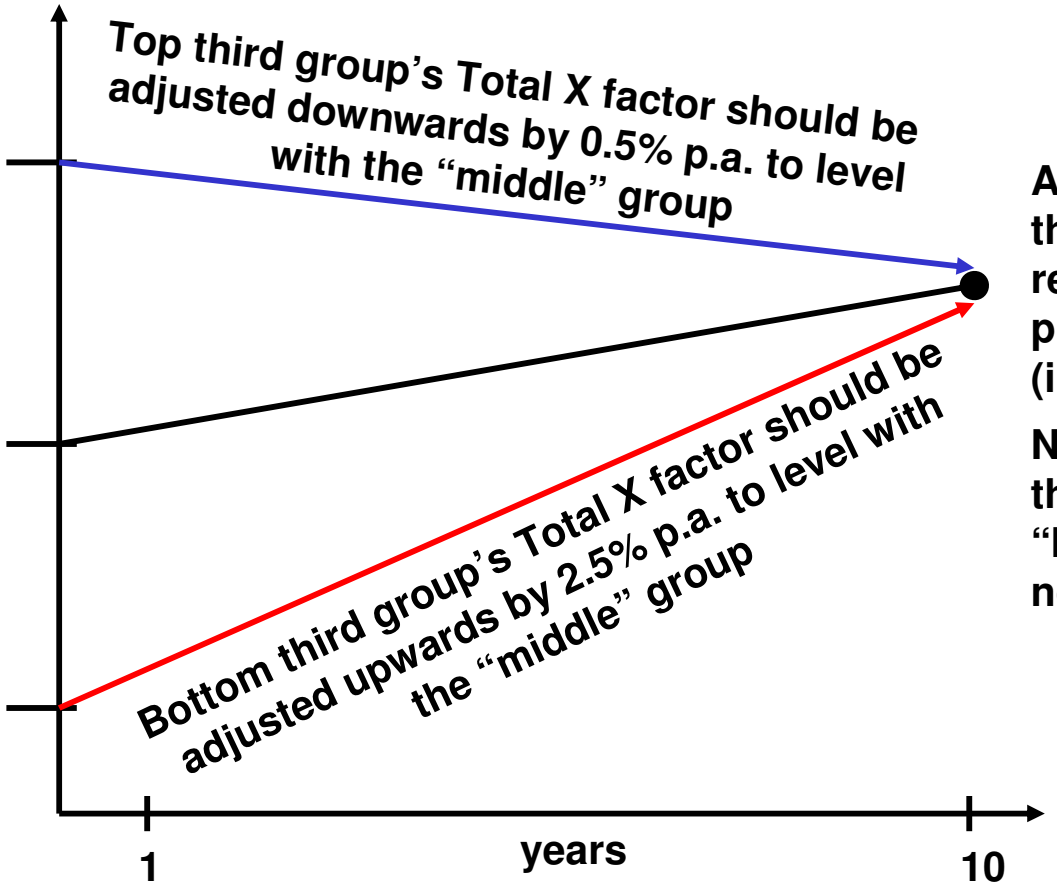
- The total X factor for a given distributor was determined as the combination of its "B" and "C" factors
  - The B factor is related to industry productivity growth and is common to all distributors and the C factors are determined for broad groups of distributors
  - C1 factor represented distributor–specific considerations reflecting the distributor's relative productivity performance (accounting for differences in operating environments as much as possible) - C1 factors took on the values -1%, 0% or +1%
  - C1 factors added to B factor, conditional on observed profitability analysis, to form peer-specific X factors
- Distributors are divided into three groups based on relative productivity performance (C1)
  - Individual distributor rankings, based on their MTFP scores, determine their allocation into the bottom third, top third or the middle third (average) group

Without C1 factors, all distributors face same target - approach preserves productivity differential



** I.e., productivity improving at the industry average B factor of 1% per annum*

C1 factors aim to levelize the productivity performance across distributors



Top third group: 15% more productive than average based on 2003 MTFP scores

"Middle" or average group

Bottom third group: 15% less productive than average based on 2003 MTFP scores

At the end of 10 years, all three groups expected to reach the average industry productivity growth rate (i.e., B factor) of 1%

Note the middle group is the target (or the "benchmark"); so it has no C factor (0%)

Some judgment applied: in order to minimize risks due to data quality, the C1 factor recommendations were reduced to minus 1% for the top third (instead of -0.5%) and plus 1% for the bottom third (instead of 2.5%). This allowed the high productivity group to maintain its absolute productivity levels while the other groups caught up.

Evaluating the capex options against Board's criteria

	Sustainable *flexible and reasonably able to handle changing and varied circumstances*	Predictable *facilitates planning by consumers and LDCs*	Effective *encourages efficiencies; provides for prudent capital investment*	Practical *open and transparent*
Index -based price adjustment (no capex module)	maybe, but not for many LDCs	in short term, predictable given forward test year sets implicit level of amortization; but less predictable in long term due to true-ups at rebasing	probably cannot provide for prudent capital investment for all LDCs	yes
Index-based price adjustments with "module" (K factor)	yes, but will depend on setting of K factor (industry template, firm-specific number)	more predictable if K factor set at start of IRM	yes	yes
Forward-looking test years (effectively capital project pre-approval)	maybe, but not all LDCs will be comfortable forecasting out and facing prudency reviews	more predictable because of pre-approval for forward test years	yes, although prudency reviews maybe contentious	maybe less so, due to prudency reviews
Capital cost tracker (actual spend tracked)	yes	less predictable for forward planning purposes, as actual capex will not be known in advance	yes, if incentives built in	yes