

Comparing the Price Index of Operating Costs (PIOC) and the RGB Income and Expense Study

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The New York City Rent Guidelines Board (RGB) uses two methods for measuring the change in the annual Operations and Maintenance (O&M) expenses paid by owners of rent stabilized units in New York City.

The RGB **Income and Expense Study (I&E)** provides an analysis of expenses as reported by owners in the Real Property Income and Expense (RPIE) statements as required by Local Law 63, enacted in 1986. These expenses are submitted annually to the NYC Department of Finance and represent reported expenses by most landlords with stabilized units based on the most recent completed calendar year at the time of filing. As with any data collection effort, there are some concerns with data quality and accuracy (discussed further below). However, these reported expenses should be close to the actual O&M costs for the reporting buildings, and can be used to estimate the O&M costs for all stabilized buildings. In general, the I&E data should be representative of actual expense changes, at least for the buildings with 11 or more units which must submit full RPIE reports annually. However, it takes about a year for the I&E data to be made available by the Department of Finance. For example, the most recent I&E data that could be used for the 2013 Guidelines was from 2011.

The RGB **Price Index of Operating Costs (PIOC)** gathers prices for a market basket of goods and services used in the operation and maintenance of rent stabilized buildings in NYC and applies those to estimate cost changes from one year to the next. This is the same approach used by the Consumer Price Index (CPI) and other similar indices, but for the goods and services typically purchased by building owners. The key assumption here is that the actual quantities of the various items purchased do not change significantly over time, so the quantities purchased in the original survey are close to those purchased now.

The PIOC is composed of *items* which are individually priced and are then grouped into *components* such as Taxes, Labor, and Contractor Services. The I&E provides data for a similar, but slightly different, set of *components*. The PIOC measures changes in prices of these items, not actual expenses. But it is timely – price changes through March 2013 were used to help determine the 2013 Guidelines.

The rates of increase in overall operating costs from the I&E have been smaller than those shown by the PIOC in recent years. That leads to three questions:

- How different are the PIOC and I&E estimates?

- Why are these two indices different?
- How should the PIOC be improved?

This analysis uses data from the 1992-2012 PIOC, which cover estimated cost changes from April 1992 through March 2012. For the I&E, it uses the filings from 1991 through 2011 (with the exception of 2003, where no useful data were available). This data is from RGB records and is included in Appendix 1 and Appendix 2.

How different are the PIOC and I&E estimates?

A simple compound growth model was fit to the overall time-series data and to the component-by-component time series. The model assumes that the cost each year will be B% higher than in the previous year and estimates the value for x. Formally, $cost = A * (1 + B)^t$ where A and B are estimated coefficients and t is the year after 1991. This model provides regression statistics including the R² for goodness of fit and the Standard Errors for each coefficient. The table shows a summary of the results. Full results are shown in Appendix 3.

IE component	Avg. Rate per year	+/-	PIOC component	Avg. Rate per year	+/-
Taxes	4.81%	0.88%	Taxes	5.77%	0.59%
Labor	2.82%	0.25%	Labor	3.66%	0.11%
Fuel	6.16%	1.78%	Fuel Oil	8.35%	1.47%
dUtilities	4.35%	0.58%	Utilities	5.20%	0.48%
Admin	4.63%	0.57%	Management	4.34%	0.16%
Insurance	4.18%	1.12%	Insurance	6.47%	1.08%
Maintenance	2.79%	0.50%	Contractor	3.79%	0.20%
Misc.	4.61%	2.15%	Parts & Supplies	1.88%	0.20%
			Replacement	1.73%	0.24%
Total	4.28%	0.56%	Total	5.21%	0.44%

Overall, the PIOC grew, on average, by about 5.2% per year during this 21-year period and the I&E grew by about 0.9 percentage points less, 4.3%. The “+/-” column is twice the standard deviation, so it gives a rough idea of the accuracy of the estimate. While it would be easy to calculate the statistical significance of the difference, one should be skeptical of putting too much trust in statistical tests when the sample size is small and the data is highly correlated

Still, there is some difference and the PIOC changes appear to be larger than the changes in expenses shown by the I&E data.

Regressions were also run against the first half and second half of the period. In the first half, the estimated growth rate for the PIOC is 2.9% annually and the estimated growth rate for the I&E is 3.0%. In the second half, the estimated rate for the PIOC is 6.2% annually and the I&E is 4.3%. So the data suggests that the divergence between the two approaches is accelerating.

To get a better understanding between the differences of these two measurements of expense, we can examine the differences in **annual** growth rates between the individual components. In terms of the components,

- Taxes differ by about 1%, which is somewhat surprising because both methods currently use calculations based on data from the Department of Finance. But the early years of the I&E calculations were based on reported tax payments, so the series may not be directly comparable.
- Labor could be influenced by several factors, including the relative prevalence of union and non-union labor. In any case, the growth rate estimated from the PIOC data is about 0.8% higher than the I&E.
- The growth rate for Fuel is 2.2% higher in the PIOC than in the I&E, though both are volatile because of how much fuel prices change. (This is shown in the larger standard error values).
- Utilities costs grow about 0.8% more in the PIOC than in the I&E, and again these values are fairly volatile because of the effects of fuel prices.
- Administration costs in the I&E grow slightly faster than Management in the PIOC, by about 0.3%. This may be because of the two approaches classify the costs that are part of “Administration” or “Management”.
- Insurance is 2.3% higher in the PIOC, but insurance prices have also been volatile and the PIOC collects actual costs for a sample of buildings. In the past, some analyses have been done on the effects of changes in coverage.
- Maintenance and Miscellaneous in the I&E come closest to matching Contractor Services, Parts & Supplies, and Replacement Costs in the PIOC. But the match isn’t all that good from one to another. Therefore, it is difficult to make any conclusions about how different the estimates are.

Why are there differences?

Both approaches attempt to measure changes in costs. Both approaches also have limitations. It’s important to review those limitations and then develop hypotheses about why the series diverge. For some of the possible reasons, it’s also possible to do some testing of the hypotheses.

PIOC: process and limitations

Owners were initially surveyed about their detailed expenditures on various goods and services. These were categorized into the nine PIOC components and, within each component, to a set of items. Weights were then calculated for the items. If, in that original survey, owners spent 10% of their O&M budget on insurance, then the “expenditure weight” for insurance was 10%. If Administrative Costs was 15%, then the category would get a weight of 15%. Thus, each of the nine components were weighted accordingly.

The same process was used to identify weights for the items in each component. For example, if half of the original expenditures in the Administrative Costs component were for Management Fees and 20% for Legal Services, the item weights would be 50% and 20% respectively.

At that point, specifications were created for representative expenditures for each item, for example painting a one-bedroom apartment. And current prices were collected for each of those specifications.

The next year, new prices were collected for each specification (spec), along with confirmation of previous prices to improve data quality. By using the change in each price and the weight on that particular item, the data could be rolled up to overall estimates of the Price Index.

But there is one more step. After completing the Price Index each year, the change in prices are used to recalculate the expenditure weights for the next year. Consider a simple example, with a price index containing two components, each originally comprising 50% of expenditures:

- First year
 - Painting(\$500) + Plumbing(\$500)= Total Expenses(\$1,000)
- Second year
 - Expenditure weight for painting = $\$500/\$1000 = 50\%$
 - Expenditure weight for plumbing = $\$500/\$1000 = 50\%$
 - Painting, \$600
 - Plumbing, \$500
 - Total Expense, \$1,100
 - Price index for painting = 20% increase
 - Price index for plumbing = 0% increase
 - Overall price index = $\$1100/\$1000 = 10\%$ increase
- Third year
 - Expenditure weight for painting = $\$600/\$1100 = 55.5\%$
 - Expenditure weight for plumbing = $\$500/\$1100 = 45.5\%$

This recalculation of weights allows the Price Index to include the effects of all previous price changes in the breakdown of the owner's expenditures.

However, it is only the effects of **price** changes that get included in the weights. If owners responded to these prices or other factors by changing **how much** they buy, for example relatively less painting or relatively more plumbing, the year-by-year PIOC would not capture that change. That requires analyzing the full range of expenses, which would necessitate doing an expenditure survey each year.

In a pure price index, this is the methodology. The PIOC is actually a hybrid – most specifications are price-based, but some items (real estate taxes, management fees, insurance, non-union labor) are based on surveys of actual expenses by owners, or data from other agencies. Also, estimates for fuel oil and natural gas for heating are based on a combination of monthly prices and temperatures, which affect the

amount of fuel needed each month. In general, though, the overall methodology is a price index.

There are several ways in which the PIOC price changes might not be representative of actual changes in expenses, especially over a long period:

- The item specifications may no longer be representative of what owners actually buy. For example, the PIOC includes prices for Lease Forms as representative of general office supplies. It has a very small weight and practically no effect on the overall PIOC, and few owners buy preprinted Lease Forms anymore, they use downloadable versions.
- The item weights within the nine components could be incorrect. For example, the shift of fuel use away from #6 oil towards #2 and #4 oil should affect the relative weights of those price changes.
- The weights of the components could have shifted. A shift from oil to gas heating should lead to higher weights for Utilities and lower weights for Fuel.
- Finally, owners could change the overall quantities of what they buy. The PIOC is designed to show the change in prices. But costs are based on “price times quantity”, and the quantity can change. For example, owners might invest in energy conservation improvements and reduce their quantity (and cost) for fuel. But the PIOC would only show the change in fuel prices, not the change in overall cost.

All of these limitations have little effect in any particular year because, in a single year, there are only a limited number of adjustments made by owners in their buying patterns. Over time, these adjustments will build up. A detailed comparison between 2013 and 2012 in what owners purchased would probably show only minor differences. But there would be major differences in a comparison between 2013 and 1983, the year of the last PIOC expenditure survey. And those 1983 expenditures are the basis for the quantities that underlie the PIOC.

Any time owners can become more efficient and use fewer goods and services, whether it's by advertising online instead of in the newspapers, or by competitive bidding to change insurance carriers, they will reduce their costs. The PIOC will not automatically capture those efficiencies.

I&E: process and limitations

Owners must submit categorized reports, RPIE statements, of their expenses annually, for buildings with 11 or more units. This data is processed and summarized, actual tax billings are added, and the summary information is provided to the Rent Guidelines Board. The RGB staff then uses a set of weights derived from the *Housing and Vacancy Survey* (HVS) to develop estimated costs by borough and citywide.

There are five concerns with the I&E data for this analysis:

- Since the I&E study does not include 6-10 unit buildings, the results could be distorted in some way.
- The most recent I&E data is made available about a year after the end of the reporting period, so it is somewhat out of date. For example, the I&E data available for the 2013 Guidelines was from calendar year 2011.
- Owners may make errors in classifying their expenses, particularly in deciding whether a particular expense is reportable as an operating cost or should not be reported.
- The I&E methodology has changed over time, with improved data collection, somewhat modified classification rules, and use of tax bills rather than reported taxes. So the data – and related year-to-year cost increases – may not really be comparable.
- While all buildings with 11 or more stabilized units are required to file RPIE data, compliance is never 100%, and some data is always incomplete, inconsistent, or otherwise unusable. There could also be errors introduced by weighting since the RGB only receives summary information by borough and building size class, not the raw data for each of the reporting buildings.

How the differences in the approaches affect the results

There are several possible reasons for the differences between the PIOC and the I&E that can be analyzed given the data.

Possibility 1: The I&E might not be representative because it excludes 6-10 unit buildings.

Overall, 6-10 unit buildings make up 42.1% of the stabilized *buildings* in the 2013 PIOC tax sample, but only 9.2% of the stabilized residential *units*. Over 90% of those 6-10 unit buildings were built before 1947.

If the costs for smaller buildings were increasing more quickly than for larger buildings, the I&E might underestimate total costs. There is limited information in the I&E for analyzing this, but there are a few indicators.

First, we can look at the cost increases for other similar, but larger, buildings in the I&E study. Over the past four years, the cumulative cost increase for pre-47 buildings in the I&E have been:

- 11-19 units: +10.31%
- 20-99 units: +12.16%
- 100+ units: +10.30%

If the 6-10 unit buildings had their costs increasing much faster than the I&E as a whole, one might expect the increase for 11-19 unit buildings to be more than that for 20-99 unit buildings, and both to be more than the increase for 100+ unit buildings. In this limited analysis, there is no such pattern.

Second, consider the fact that the smaller buildings are under 10% of the total population, which means that their costs would have to increase much faster than

the costs for larger building to raise the growth rate for all buildings. Consider a simplified example where between year 1 and year 2 costs rose in all buildings by x%, from ___ to \$1050:

- Large buildings (91% of all units)
 - cost per unit in year 1: \$1000
 - cost per unit in year 2: \$1040
- PIOC growth rate from year 1 to year 2
- Smaller buildings (9% of all units)
 - Cost per unit in year 1: \$1000
 - Calculated cost per unit in year 2, to make the overall average for all buildings \$1050: \$1151
 - Calculated growth rate required for small buildings: 15.1%

In general, it would take extraordinary growth rates in the operating costs for small buildings to raise the annual growth rate found by the I&E study a meaningful amount. To match the PIOC, the growth rate in annual operating costs for small buildings would have to be 7-10% higher than the I&E values for larger buildings. And those growth rates in costs are not sustainable. For example, if the annual operating cost per unit for 6-10 unit buildings had been at the city average of \$370 in 1991, and grew at 10% per year, it would have been about \$2500/unit in 2011.

Third, owners of smaller buildings may submit an “EZ” version of the RPIE with limited information. The samples are fairly small, and self-selected, but they show average operating costs around \$900/unit per month for the past few years:

- 2008: \$660.58 per unit per month
- 2009: \$980.67
- 2010: \$923.92
- 2011: \$904.08
- 2012: \$970.83

This is about \$100/month higher than the I&E study shows for larger buildings. If this data was from a scientific sample, the large increase between 2008 and 2009 would need to be analyzed further, and the steady costs for 2009-2012 would also be surprising. With self-selected unaudited data, it is hard to make any solid conclusions. It seems very likely that operating costs are similar for the smaller and larger buildings, though expenditure patterns could be very different.

The 6-10 unit buildings may or may not have operating costs per unit that are higher than the larger buildings included in the I&E study. But there is no evidence in this data that the rate of growth in their operating costs is consistently higher than the rate for larger buildings.

Possibility 2: Owners may be over- or underreporting their costs for the I&E.

The key point here is that this analysis is concerned with growth rates, not nominal expenditures. If owners were to consistently over- or under-report their

expenditures for the I&E study, that would have only a minor effect on the growth rate. For example, if owners were to consistently exclude their costs for natural gas, it would affect the average cost per unit in the I&E study. But it would only affect the growth rate in operating costs when the year-to-year change in gas costs was much more, or much less, than in the costs for other goods.

However, over- or underreporting could affect the long-term growth rate if the reporting rules changed significantly over time. It is possible, but it would have to be a large change. For example, consider a scenario where:

- nearly all owners included a type of operating cost in the first five years of RPIE reporting, 1991-1995
- half did so in the next five years, 1996-2000
- one-quarter did so from 2001-2005
- none did so after 2005

A pattern like that would artificially reduce the calculated growth rate for the I&E data. Since each period would redefine what was considered an “operating cost,” the results would not really be comparable from year to year.

It has been suggested that the rules for RPIE reporting have become more strict over the past two decades so that some more recent expenses may be excluded or classified as capital rather than operating costs. But even if that is true, consider what would be required to affect the calculated growth rate from the I&E data. To increase that growth rate by 0.9%, approximately 20% of the I&E “operating costs” in the early years would have to have been over-reporting of invalid costs. So, while this is a concern, it does not appear to be a major contributor to the difference between the two studies.

Possibility 3: Unrepresentative PIOC specifications

The PIOC items could be another source of difference. The items in each category are supposed to be representative of what owners buy. If they’re not, and if the true prices of the items are increasing at a slower rate than the PIOC items, then the PIOC could be overstated. But the items that are most problematic are also the ones with the lowest weights in the PIOC. For example, if few people buy landline telephones any more, and the costs of cell phones, which are not collected for use in the PIOC, were to increase more slowly than the cost of landlines, the effect of omitting the costs of cell phones on the overall Price Index would be minimal. Therefore, unrepresentative PIOC specifications are not likely to be major contributors to the difference.

Possibility 4: Price increases and Expense increases are not the same

The PIOC estimates changes in prices. But any business owner will try to limit their costs. They do this by modifying what they buy. So, as prices for one good goes up, owners will shift to other products or reduce quantities to try to limit their costs. All else being equal, a price index will increase faster than actual costs. However, this

effect should be fairly constant, since owners will make those adjustments every year.

Possibility 5: Owners shift their expenditure patterns over time

The PIOC assumes that owners buy the same market basket of goods and services as they did in the original expenditure survey. While it uses actual costs in a few important areas – taxes, management fees, insurance, and non-union labor – it assumes constant quantities for all the priced goods. But those quantities have undoubtedly changed over time. This is likely to be the major source of the differences between the two studies since it is the one that best explains the way the two estimates are getting less and less similar as time goes on.

So, while there may be other contributors, the key appears to be changes in how owners change their spending in response to changes in prices and the goods and services that are available.

How can the PIOC be improved?

There are three aspects of the PIOC which can be improved using the I&E and other data.

- Overall expenditure weights
- Item weights
- Item specifications

Overall expenditure weights

A price index, like the PIOC, is an excellent tool for tracking short-term changes in the prices of a set of goods and services.

But it needs to be based on real expenditures periodically or it will become increasingly unconnected to the real market basket being purchased.

The I&E provides those real expenditures, but the data is over a year old when the RGB does its analysis and determines the guidelines. In cases where there is a major change in prices – an energy shock, for example, the Board needs to capture price changes sooner.

So, one option would be to use the expenditures identified in the I&E to create component weights for the PIOC. For example, the 2013 I&E study has the following component weights (compared to the 2013 PIOC component weights):

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<u>2013 I&E Component</u>	<u>Weight</u>	<u>2013 PIOC Component</u>	<u>Weight</u>
Taxes	26.5%	Taxes	29.6%
Labor	11.4%	Labor	12.9%
Fuel	13.9%	Fuel	13.2%
Utilities	11.3%	Utilities	16.3%
Admin	16.3%	Admin	7.2%
Insurance	12.7%	Insurance	6.8%
Maintenance	4.6%	Contractor	12.0%
Other	3.3%	Parts & Supplies	1.4%
		Replacement	0.6%

There are two technical issues involved in using the I&E weights. First, the individual items in the PIOC would need to be allocated to the corresponding I&E components. Appendix 4 provides a possible allocation using the detailed RPIE reporting lines; an allocation using the summarized components from the I&E study would be slightly simpler – for example, it would combine the “Light and Power” and “Water and Sewer” lines into a “Utilities” component.

Second, the I&E weights are from a year earlier than the PIOC. So those data should be updated based on the previous PIOC prices. For example, for 2014 this would involve:

- Taking the I&E costs per component from 2012
- Updating those to estimated 2013 costs based on the 2013 PIOC
- Adjusting the weights based on those 2013 costs

As with the PIOC weights now, if the prices for one component increased more than for another component, its relative weight in the 2014 PIOC would increase.

This approach would mean that the expenditure weights for the PIOC components would never be more than two years out of date, which would be a major improvement.

Item Weights

The I&E data does not provide any detailed breakdown of what was purchased within any of the operating cost components. However, in certain critical areas, the PIOC has already been using the annual survey data to modify item weights.

A recent PIOC survey requested information on expenses for natural gas and oil. These were used to modify the item weights for the associated specifications based on actual expenditure patterns. This approach should be continued. The annual survey should collect data for one area of expenses each year.

For example, the survey already collects data on non-union labor costs and the value of apartments provided to building superintendents every year. So, for instance, in the year focusing on “Labor” costs, it could also collect expense information on union labor costs and on benefits.

In the “Services” year, it could collect costs for painting contractors and maintenance and repair services.

This approach would provide new data for updating item weights every 5-6 years without greatly increasing the data reporting burden for owners.

Item Specifications

RGB staff has modified item specifications in the past, particularly when certain items become unavailable. This requires identifying a new item, collecting price data for both the current year and the previous year, and then using the new item going forward.

However, changing the style and size, for example, of a priced refrigerator is somewhat different from saying “we will no longer price office supplies, we will price laptops instead”.

The main opportunity for modifying the items would come in the annual surveys to collect costs for the item weights. The I&E forms include a listing of typical costs to be included in each component. The RGB staff can collect data on costs of these types in the annual surveys and identify new item specifications where necessary. Old items which no longer represent significant costs can be retired.

Limitations

After all is said and done, the PIOC still measures prices, not costs. It can be expected to slightly overestimate changes in costs. However, once the PIOC and I&E are working with similar components and the PIOC weights are based on the I&E, comparisons can be done. For example, the 2013 PIOC increase could be compared to the I&E data for 2013 released in mid-2014, the 2014 PIOC to I&E data released in mid-2015, and so forth. This will provide a check on how much the PIOC estimates differ from actual expenditure shifts.

This analysis has looked at the overall PIOC for Rent Stabilized Apartments. The additional apartment indexes present their own challenges:

- Costs for Pre-47 and Post-46 buildings are reported in the I&E, so this approach can be used to calculate them.
- Costs for heating buildings with Oil and natural Gas were included in a recent annual survey, so those weights can be calculated.

- Master-metered buildings with stabilized units are very rare and there are no useful data for calculating weights; it would probably be best to simply retire that calculation and use the overall Apartments Index.

For Hotel-stabilized and Loft buildings, there is no useful data in the I&E study that describes their patterns of expenditures. The best approach is probably to continue with the current methods, perhaps converting to the I&E components to make the data comparable.

If the RGB decides to convert to this new approach in 2014, or to run the old and new methods in parallel, that will involve a significant increase in workload for 1-3 years. After that point, it would be reasonable to do new expenditure surveys for hotels and lofts to improve their weights; the populations of those buildings are fairly small so the surveys would not be too burdensome.

Note that, if the RGB implements the new approach, it will be hard to compare historical data, especially for the categories being revised. Taxes, Fuel, Utilities, Labor, and Insurance should be comparable. The others will be more challenging.

Conclusions

The I&E data provides a superior historical estimate of changes in O&M costs for all stabilized units than the PIOC does. The PIOC has become increasingly inaccurate, diverging from the I&E more and more as time goes on. There is some evidence that a major cause is very old baseline data on expenditures. The PIOC is also a price index and actual expenditures should rise somewhat slower than prices.

However, the I&E data cannot be used for current estimates since it lags the PIOC by about a year. The PIOC price and cost increases should provide better information about recent changes.

The approach proposed here is to:

- Use the most recent I&E to create the component weights for each year's PIOC. This will connect the PIOC much more closely to what owners have actually been buying so that we can better estimate the overall effect of price changes.
- Annually survey owners about their costs for various items within a single component, to update the item weights and allow development of improved items and specifications. Since this is not necessary for taxes and insurance (which have one item each in their components), it should allow updates of items weights across the PIOC every 5-6 years.
- If possible, survey hotel-stabilized and stabilized loft buildings every 5-10 years to update the expenditure weights for those indexes.

These steps should give us a stable, reproducible PIOC which will stay current and track better against actual expenditures.

Appendices

Data used in the Analysis

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Appendix 1 - I&E Operating Expenses per Unit

<u>IE study</u>	<u>Data from</u>	<u>Tax</u>	<u>Labor</u>	<u>Fuel</u>	<u>Utilities</u>	<u>Admin.</u>	<u>Ins.</u>	<u>Maint.</u>	<u>Misc.</u>	<u>Total</u>
1993	1991	\$90	\$52	\$41	\$38	\$43	\$21	\$70	\$27	\$382
1994	1992	\$95	\$55	\$41	\$40	\$45	\$21	\$72	\$27	\$395
1995	1993	\$97	\$58	\$41	\$42	\$46	\$21	\$74	\$28	\$409
1996	1994	\$98	\$58	\$40	\$42	\$47	\$22	\$77	\$28	\$415
1997	1995	\$99	\$61	\$38	\$43	\$50	\$24	\$78	\$29	\$425
1998	1996	\$101	\$64	\$45	\$44	\$52	\$24	\$81	\$30	\$444
1999	1997	\$107	\$64	\$43	\$47	\$55	\$23	\$84	\$31	\$458
2000	1998	\$105	\$66	\$35	\$46	\$60	\$22	\$92	\$33	\$459
2001	1999	\$104	\$65	\$35	\$48	\$61	\$21	\$95	\$35	\$464
2002	2000	\$108	\$68	\$53	\$53	\$62	\$22	\$100	\$38	\$503
2003	2001	\$114	\$70	\$54	\$55	\$66	\$24	\$104	\$43	\$531
2004	2002	\$133	\$72	\$46	\$53	\$72	\$33	\$110	\$51	\$570
2006	2004	\$167	\$75	\$65	\$59	\$76	\$44	\$113	\$55	\$654
2007	2005	\$159	\$81	\$83	\$63	\$75	\$42	\$111	\$64	\$679
2008	2006	\$165	\$80	\$84	\$64	\$78	\$42	\$114	\$67	\$695
2009	2007	\$178	\$85	\$97	\$72	\$81	\$43	\$118	\$64	\$738
2010	2008	\$191	\$88	\$115	\$79	\$88	\$40	\$118	\$70	\$790
2011	2009	\$200	\$89	\$92	\$81	\$92	\$38	\$117	\$71	\$781
2012	2010	\$212	\$90	\$96	\$87	\$91	\$36	\$118	\$59	\$790
2013	2011	\$215	\$93	\$113	\$92	\$132	\$37	\$104	\$27	\$812

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Appendix 2 - PIOC Annual Percent Increases

<u>PIOC Changes</u>	<u>Taxes</u>	<u>Labor</u>	<u>Fuel</u>	<u>Utilities</u>	<u>Contractor</u>	<u>Admin.</u>	<u>Ins.</u>	<u>Parts</u>	<u>Replace.</u>	<u>Overall</u>
1992	11.04%	5.25%	-10.92%	6.61%	2.40%	2.83%	2.34%	2.48%	3.79%	3.98%
1993	3.11%	5.63%	5.18%	12.75%	2.51%	3.80%	-0.47%	1.03%	4.15%	4.72%
1994	2.26%	4.28%	-0.50%	2.07%	0.87%	3.66%	0.76%	0.99%	1.56%	2.04%
1995	1.37%	4.10%	-12.66%	-4.00%	2.38%	3.79%	5.18%	-0.45%	0.21%	0.14%
1996	2.96%	3.15%	29.60%	7.79%	1.79%	3.46%	5.01%	0.84%	0.97%	5.95%
1997	2.40%	2.26%	0.41%	2.93%	3.38%	3.89%	1.87%	1.45%	1.00%	2.43%
1998	1.23%	2.69%	-15.02%	2.34%	2.67%	3.29%	-1.52%	1.93%	0.64%	0.13%
1999	0.37%	3.40%	-18.37%	-0.43%	3.50%	2.87%	3.46%	2.17%	1.67%	0.03%
2000	5.18%	2.62%	54.79%	5.68%	4.58%	3.96%	0.66%	1.93%	0.77%	7.82%
2001	5.45%	3.95%	33.33%	14.95%	3.63%	4.06%	4.86%	0.81%	0.97%	8.73%
2002	6.63%	4.03%	-36.09%	-9.94%	3.85%	4.64%	16.50%	0.94%	-0.60%	-1.61%
2003	14.80%	3.45%	66.91%	21.71%	4.81%	5.40%	40.46%	0.41%	1.41%	16.90%
2004	16.20%	4.50%	-2.80%	0.80%	4.10%	4.00%	14.70%	1.20%	1.00%	6.90%
2005	1.20%	3.50%	20.00%	8.40%	4.50%	4.00%	8.90%	2.60%	3.10%	5.84%
2006	7.80%	2.50%	22.80%	7.90%	5.90%	6.50%	2.50%	5.50%	4.50%	7.80%
2007	5.79%	8.09%	0.46%	6.29%	5.59%	6.93%	1.88%	3.03%	1.60%	5.14%
2008	0.32%	3.98%	37.35%	8.89%	4.62%	5.26%	2.33%	2.28%	3.99%	7.78%
2009	11.72%	2.88%	-10.12%	10.91%	2.77%	4.05%	-2.90%	2.65%	6.07%	3.96%
2010	10.12%	3.13%	0.46%	-1.68%	2.32%	4.11%	-2.02%	1.72%	0.93%	3.43%
2011	3.51%	2.66%	23.06%	7.66%	2.65%	2.88%	-0.36%	3.69%	0.64%	6.13%
2012	7.47%	2.49%	1.63%	-4.01%	3.25%	2.58%	2.51%	3.70%	3.25%	2.77%

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Appendix 3 - Regression Analysis Results

I&E	<u>Component</u>	<u>Intercept</u>	<u>Std Err</u>	<u>Growth Rate</u>	<u>Std Err</u>	<u>R2</u>	<u>degrees of freedom</u>
	Taxes	82.0	0.034	1.048	0.003	0.94	18
	Labor	53.7	0.008	1.028	0.001	0.99	18
	Fuel	31.9	0.077	1.062	0.007	0.82	18
	Utilities	36.2	0.022	1.044	0.002	0.96	18
	Admin	42.0	0.029	1.046	0.002	0.95	18
	Insurance	19.2	0.065	1.042	0.006	0.75	18
	Maintenance	73.0	0.029	1.028	0.002	0.87	18
	Other	26.2	0.106	1.046	0.009	0.58	18
	Overall	363.2	0.018	1.043	0.002	0.98	18
PIOC	Taxes	0.875	0.034	1.058	0.003	0.95	19
	Labor	1.009	0.007	1.037	0.001	1.00	19
	Fuel	0.767	0.086	1.084	0.007	0.86	19
	Utilities	0.960	0.028	1.052	0.002	0.96	19
	Contractor	0.945	0.012	1.038	0.001	0.99	19
	Administrative	0.971	0.009	1.043	0.001	0.99	19
	Insurance	0.869	0.063	1.065	0.005	0.88	19
	Parts	0.957	0.012	1.019	0.001	0.95	19
	Replacement	0.987	0.014	1.017	0.001	0.92	19
	Overall	0.912	0.026	1.052	0.002	0.97	19

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The regressions fit a constant growth rate to the actual costs or PIOC percent increases. They take the time series data and see what constant growth rate provides the best fit to the data.

The key parameters here are the estimated growth rates. For example, consider the first line. The value of 1.048 means that the regression model estimates that operating costs for Taxes from the I&E study will grow by about 4.8% per year. The standard error is 0.3%, so the expectation is that, 95% of the time, the true value would be between 4.2% and 5.4%, 95%. While this depends on various statistical assumptions, it provides some guidance for how well the model fits the data.

The R2 (r-squared) values are another indicator of the fit. In that same line, the R2 of 0.94 means that the model explains about 94% of the variance in the data. And the degrees of freedom measure how much of the data the model tries to explain – in this case, we have 19 or 20 data points and are estimating 2 parameters, so we have 17 or 18 degrees of freedom left.

The intercepts for the I&E are the model's estimate of the costs in dollars per unit per month in the first year of the analysis, 1991. The PIOC intercepts have no actual meaning but improve the statistical properties of the model.

Appendix 4 - PIOC Items Assigned to I&E Components

<u>I&E Component</u>	<u>PIOC Item</u>	<u>PIOC Item Description</u>
Taxes	101	Taxes Fees and Permits
Advertising	604	Newspaper Ads
Cleaning Contracts	803	Wet Mop
	804	Floor Wax
	806	Pushbroom
	807	Detergent
	808	Bucket
	809	Washers
	811	Pine Disinfectant
	812	Window/Glass Cleaner
Fuel	301	Fuel Oil #2
	302	Fuel Oil #4
	303	Fuel Oil #6
	405	Gas #2, 65,000 therms
	406	Gas #3, 214,000 therms
	407	Steam #1, 1.2m lbs
	408	Steam #2, 2.6m lbs
Insurance	701	Insurance
Interior Painting and Decorating	501	Repainting

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	805	Paint
Leasing Commissions	606	Lease Forms
	605	Agency Fees
Light and Power	401	Electricity #1, 2,500 KWH
	402	Electricity #2, 15,000 KWH
	403	Electricity #3, 82,000 KWH
	404	Gas #1, 12,000 therms
Management and Administration	601	Management Fees
	602	Accountant Fees
	603	Attorney Fees
	607	Bill Envelopes
	608	Ledger Paper
	409	Telephone
Repairs and Maintenance	502	Plumbing, Faucet
	503	Plumbing, Stoppage
	504	Elevator #1, 6 fl., 1 e.
	505	Elevator #2, 13 fl., 2 e.
	506	Elevator #3, 19 fl., 3 e.
	507	Burner Repair
	508	Boiler Repair, Tube
	509	Boiler Repair, Weld
	510	Refrigerator Repair
	511	Range Repair

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- 512 Roof Repair
- 513 Air Conditioner Repair
- 514 Floor Maint. #1, Studio
- 515 Floor Maint. #2, 1 Br.
- 516 Floor Maint. #3, 2 Br.
- 813 Switch Plate
- 814 Duplex Receptacle
- 815 Toilet Seat
- 816 Deck Faucet

Wages and Payroll

- 201 Payroll, Bronx, All (Union)
- 202 Payroll, Other, Union, Supts.
- 203 Payroll, Other, Union, Other
- 204 Payroll, Other, Non-Union, All
- 205 Social Security Insurance
- 206 Unemployment Insurance
- 207 Private Health & Welfare

Water and Sewer

- 410 Water & Sewer

Ineligible

- 901 Refrigerator #1
- 902 Refrigerator #2
- 903 Air Conditioner #1
- 904 Air Conditioner #2
- 905 Floor Runner
- 906 Dishwasher
- 907 Range #1
- 908 Range #2