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Explaining the Rent-OER Inflation Divergence, 1999-2006

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Abstract

Between 1999 and 2006, there were two episodes during which inflation in the Rent index in the CPI diverged markedly from inflation in the index for Owner's Equivalent Rent (OER); early in 2007, these series began to diverge again. Such divergence often prompts many to question CPI methods. A key difference between these two series is that OER indexes are based upon rents which have received a utilities adjustment – an adjustment which is necessary because the OER index is intended to track pure rent-of-shelter, not shelter-plus-utilities. Critics have claimed that the Rent-OER inflation divergences stem from an inappropriate utilities adjustment.

This claim is false. In this paper, we decompose the Rent-OER inflation differential into its various determinants, and explore the multiple causes of this divergence over time. There is only one divergence episode – of only six months duration – which is primarily attributable to the utilities adjustment procedure. Indeed, the utilities adjustment sometimes *reduced* potential divergence between the two series.

Instead, the main culprit is rental market segmentation; that is, different rent inflation rates were experienced by different parts of the rental market. Before 2003, the Rent-OER inflation divergence mainly resulted from divergent rental inflation rates *within* metropolitan areas: areas with a higher proportion of renters experienced higher rental inflation. After 2004, similar divergent inflation *across* metropolitan areas resulted in higher Rent inflation. Compared to other units, rent control units experienced *higher* inflation in 2004 (and, to a lesser extent, before mid-2001 and in 2006), which increased Rent inflation but not OER inflation. Finally, in early 2007, there was a *sizable* divergence between OER and Rent inflation, driven mostly by divergent rental inflation rates within metropolitan areas; the extent of the divergence only becomes evident once the effect of the utilities adjustment is accounted for.

1 Introduction

Housing costs are a substantial part of most American's monthly outlays. As a result, these costs account for about one-third of the total weight of the Consumer Price Index (CPI). Hence, accurate measurement of shelter costs is crucial to obtaining an accurate measurement of the overall inflation experienced by the average US consumer, and these costs get a lot of attention from the financial press. Within the CPI, the Bureau of Labor Statistics (BLS) produces two shelter indexes: Rent, which covers the shelter expenditures of renters, and Owners' Equivalent Rent (OER), which covers owners. This latter index is constructed using the rental-equivalence method,[1] which equates the change in a homeowner's shelter cost to the change in the market rental price of that person's home. OER is thus a rent-of-shelter concept which does not include utilities, since utilities are measurable out-of-pocket expenses for homeowners.

The Rent and OER indexes are produced using essentially the same data – market rents – and critics in the financial press often wrongly conclude that these measures should move in lockstep with each other (or, even more commonly and erroneously, that OER should move in lockstep with house prices). To understand why OER inflation can diverge from Rent inflation, one needs to know something about how these indexes are produced.

How is OER produced? The exact market rent of an owned home is, of course, unobservable. However, a well-known and empirically valid rule of thumb in real estate pricing is "location, location, location." This principle carries over to rents: internal BLS research – most recently in Verbrugge et al. (2007) – has consistently supported the notion that, outside of location, it is difficult to find any reliable predictor of rent inflation. Hence, the BLS estimates inflation in the homeowner rents using inflation in market rents of nearby rental units. (Furthermore, about one-quarter of the total BLS sample of rental units consists of detached units, so – even though there is only weak evidence that rents differ by shelter type – much of the rent sample that is used for measuring homeowner shelter cost inflation consists of the same structure type.) Ultimately,

[1] This is a measure of the shelter cost itself, i.e. the cost of obtaining shelter services from this house, which abstracts from the highly-volatile, difficult-to-measure, financial-asset aspect of homeownership. Most of the academic research suggests that this method is the best of the available methods for estimating changes in homeowner shelter costs. See, e.g., the discussion in Diewert (2003), in Poole, Ptacek and Verbrugge (2005), and the recent findings of Verbrugge (2007a).

homeowner cost inflation is estimated by re-weighting inflation in market rents, as follows.

Monthly movements in the OER index, and the Rent index, are based upon ratios of weighted averages of rents. In particular, for a metropolitan area, the BLS constructs its index for Rent (I_t^R) or for OER (I_t^O) using a "rent relative" approach. That is, for index $j = \{Rent, OER\}$,

$$I_t^j = I_{t-1}^j * R_t^j$$

where R^j is the rent relative (defined below), and t indexes months. The BLS reprices the housing units in their sample only every six months. Accordingly, the rent relative – which is used to move the index in the current month t – is defined as

$$R_t^j = \left(\frac{\sum w_i^j rent_{i,t}^j}{\sum w_i^j rent_{i,t-6}^j e^{F_{i,t}^k}} \right)^{\frac{1}{6}} =: \left(\frac{\overline{rent}_t^j}{\overline{rent}_{t-s}^j} \right)^{\frac{1}{6}} \tag{1}$$

where w_i^j is the expenditure weight for unit i pertaining to index j, and $rent_{i,t}^j$ is the period-t measure of rent from unit i that is applicable to the construction of index j. As discussed in more detail below, weights and rent measures differ across indexes: weights differ across indexes because, for example, rent control units do not enter the OER indexes; and rent measures differ across indexes because, for example, rents used in OER must be adjusted for utilities. Regional or national Rent and OER indexes are constructed via weighted-averages of area-indexes, with weights again differing across the two indexes. Period-t rent-measures are quality-adjusted via an age-bias factor $F_{i,t}^k$ (which is common across Rent and OER) to ensure that the index is measuring inflation in constant-quality units.[2]

In 1999, the BLS introduced a new rental sample. Following this introduction, the rent index and the OER index began to diverge. Over the next seven years, inflation in these series subsequently converged, diverged, converged, and diverged again; see Figure 1, which plots 12-month changes in these indexes.

[2] The age-bias adjustment is studied in Gallin and Verbrugge (2007). As this factor is common across Rent and OER, is of second-order size, and has only second-order effects in Rent-OER comparisons, it is henceforth ignored. For more details on BLS procedures, see Ptacek and Baskin (1996).

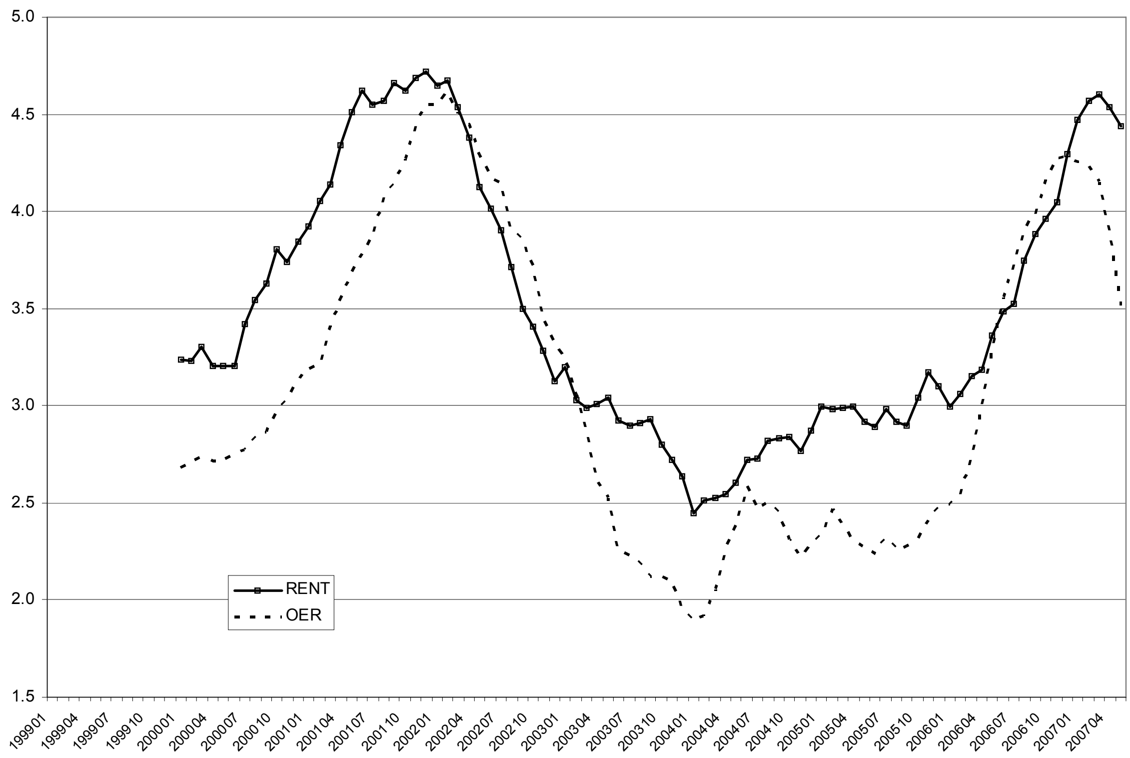

Figure 1: Divergence in 12-Month Inflation of Rent and OER

Divergence often prompts many analysts and commentators to speculate that the BLS is doing something wrong with the utilities adjustment. But this is only the first of five key differences between the Rent and OER index.[3]

The utilities adjustment is indeed a key difference, and we label it factor 1. Although both BLS indexes are based upon a single rent survey, the *rent* measures which enter (1) for the OER index must be pure-shelter-service prices and hence must exclude utilities. (This point is explained more fully in Section 2 below.) But market rents in the US are rarely pure shelter prices; most rental contracts include at least one utility. Thus, rents of utilities-included-units must be adjusted downward to take into account the utilities component of those rents. Otherwise, utilities expenditures

[3]We discuss factors with only second-order effects, namely "non-interview adjustments" and facilities adjustments, in Section 5 below. Age-bias adjustment was discussed above.

would be double-counted for homeowners – counted first as a consequence of the resultant inflation in the rents of utilities-included units, and then again as a consequence of the resultant increase in their out-of-pocket expenses on utilities. An implication is that, since the Rent index includes some utilities and the OER index does not, changes in utilities inflation will impact Rent inflation differently than OER inflation. OER inflation *should* diverge from Rent inflation if utilities inflation changes. If utilities inflation is rapid, for example, then *ceteris paribus,* Rent inflation should exceed OER inflation.

The potential factors 2 through 4 each relate to the *weights* in (1) interacting with differential inflation rates across different parts of the rental market. The weights w_i^{Rent} and w_i^{OER} differ in three distinct ways. First, $w_i^{Rent} = 0$ for some units, namely those in a special OER augmentation sample, which are termed "helper segments." This is factor 2. Second, $w_i^{OER} = 0$ for rent-controlled units. This is factor 4. Finally, $w_i^{Rent} \neq w_i^{OER}$ in general, since (for example) the OER index will place higher relative weight on units located near heavily-owner-occupied regions. This is factor 3.

The fifth potential factor relates not to weights at the level of Elementary Indexes,[4] but rather to "upper-level" weights, i.e. those relevant for the aggregation of Elementary Indexes into regional or national averages. Rent inflation in the Northeast – i.e., "average" inflation experienced by renters in the Northeast – is a weighted average of Rent inflation in Boston, in New York City, and so on. But since New York City has a greater proportion of renters than does Boston, its weight in the regional Rent index is larger than its weight in the regional OER index. Thus for example, if New York City experienced unusually high shelter cost inflation due to a temporary housing shortage, then this would increase the regional Rent index more than it would the regional OER index.

In this paper, we study the extent to which each of these factors contributed to the divergence of Rent and OER inflation depicted in Figure 1. In order to do so, we constructed a CPI Shelter Index simulator, which estimates official CPI shelter indexes to a high degree of accuracy. This enables us to change one feature at a time, and thus to construct experimental indexes, such as

[4] "Elementary Indexes" are indexes which are created directly from observed price changes. (In contrast, regional or national indexes are formed by aggregating Elementary Indexes.) In some cases – namely larger metropolitan areas like Chicago or Miami – Elementary Indexes correspond to a single metropolitan area. But in other cases, Elementary Indexes are computed by aggregating together data from several different cities.

an OER index without any utilities adjustment. Thus, we can separately determine the impact of each of the factors above.

Our four key findings are surprising. To summarize:

First, the critics are wrong: the utilities adjustment is no smoking gun. It was rarely responsible for the majority of the divergence, and indeed *reduced* the divergence almost as frequently as it increased it.

Second, the main driver of the divergence was differential rent inflation across different segments of the market.

Third, as of 2007:5, there was a *substantial* divergence in 12-month rent inflation rates across different segments of within-metropolitan area markets. In particular, loosely speaking, units in heavily owner-occupied regions were experiencing far less inflation than other units. This pattern was observed in many metropolitan areas across the country. But it is only fully evident upon controlling for the effect of the utilities adjustment.

Finally, rent-control – which is concentrated in three metropolitan areas, New York, Los Angeles, and the San Francisco Bay area – periodically had a sizable and *upward* impact on *aggregate* Rent inflation over this period.

Looking at the 2000-2007:05 period in more detail, four distinct episodes stand out. First, between 2000 and 2002, factor 3 was the main story: during this period there were divergent rental inflation rates *within* metropolitan regions, and areas with a higher Rent weight experienced higher rental inflation than did other areas. The differential impact on Rent inflation was about 0.35%. (In 2000, factor 5 also contributed: cities with a higher concentration of renter experienced higher rent inflation, with a differential impact on Rent inflation of about 0.25%.) Second, in 2003, factor 1 (utilities) was the main story: the BLS implemented an improvement to its water/sewer adjustment (described below), which reduced OER inflation by about 0.3%. Third, in the 2004-2006 period, three factors were notable: utilities; upper level aggregation (cities with a higher concentration of renters experienced higher rent inflation); and rent control. In particular, the utilities adjustment reduced OER inflation by about 0.25%; upper level aggregation caused a divergence of about 0.20%; and higher inflation in rent-control units in the Northeast and West caused overall Rent inflation to rise by nearly 0.13% on average between 2004-2005:06. Finally, in early 2007, factor 3 was mainly responsible for an enormous wedge between OER and Rent inflation, although factor 2 contributed as well. Thus, each of the five factors played a significant role, at some point, in explaining 12-month Rent-OER inflation divergence.

Looking instead at inflation over the 1999-2006 period, Rent grew about 31%, and OER grew by about 27.5%. In explaining this difference, factors 1 and 2 played only a trivial role. Factors 3 and 5 each explain about 1.2% of the difference, and factor 4 explains about 0.8% of the difference.

The outline of the remainder of this paper is as follows. Sections 2-5 follow the sequence of adjustments required to move OER to Rent. In particular, Sections 2-4 follow the sequence of adjustments required to move OER to Rent-less-rent-control: re-incorporate utilities → remove helper segments → use Rent weights in (1) → use Rent weights in upper-level aggregation; the last step is to remove rent-regulated units from Rent. Accordingly, Section 2 explores the impact of the utilities adjustment. Section 3 explores the impact of factors 2 and 3, namely of helper segments and of OER versus Rent weights in (1). Section 4 explores the impact of factor 5, upper-level aggregation weights. Section 5 explores the impact of factor 4, rent-control units, and two remaining minor differences. Section 6 then explores *regional* divergences in greater detail. Finally, Section 7 concludes.

2 Factor 1: The Utilities Adjustment

The rental equivalence method implies that, for a homeowner, the inflation in pure shelter costs equals the inflation in what that home would rent for. As noted above, "location, location, location" is an empirically valid rule of thumb. Hence, the BLS estimates inflation in homeowner rents using inflation in market rents of nearby rental units.

The BLS Rent index tracks inflation in actual rents paid, whether or not the contract includes utilities. In the US, around two-thirds of US rental contracts include at least one utility (that is, the renter does not pay a separate bill for that utility); see the American Housing Survey, 2002 Metropolitan area survey. Heat, in particular, is included in about one quarter of all US rental apartments. The prevalence of utilities-included contracts varies regionally, and also by building size and age. (See Levinson and Niemann, 2004, for details.) Thus, utilities price inflation is implicitly embedded in the Rent index.

However, OER is a rent-of-shelter concept; it seeks to track inflation in the rent that a hypothetical landlord would charge for the home. Homeowners typically pay for their own utilities directly. Thus, for this portion of the population, utilities costs are directly taken into consideration elsewhere in the CPI, and not in the item OER. If the market rent on unit i, $rent_{i,t}^{Rent}$, includes utilities, the BLS must apply a utilities adjustment in order to transform it into a pure-shelter rent measure $rent_{i,t}^{OER}$ which is admissible for use in (1) when constructing OER. It would be inappropriate to equate the imputed shelter costs of a homeowner – i.e., what a hypothetical landlord would charge to rent the unit *without utilities* – to the *utilities-included* rent of an otherwise identical unit.[5] A utilities adjustment is necessary for constructing the OER index; the only question is whether the BLS is doing it properly. (Verbrugge (2007b) studies the utilities adjustment in the CPI, and offers some recommendations.)

Many commentators have asserted that the utilities adjustment basically accounts for the divergence between OER and Rent inflation that is depicted in Figure 1.

This is false. Figure 2 depicts four series. The first is the published Rent series. The next two are experimental series. The first of these is a simulated OER series which retroactively applies the late 2003 water/sewer utilities adjustment improvement.[6] The second is a simulated OER-type series which *removes* all utilities adjustments from the OER index. (This second index is not a valid measure of OER, but it is a useful measure in that it allows one to deduce the impact of utilities adjustment on OER, and provides clues about the impact of utilities on Rent.) The last series is the published OER series, which includes all the historical utilities adjustments.

[5] Putting this somewhat differently, if utilities from a utilities-included rent were not removed, then utilities expenditures would be double-counted for homeowners – counted first as a consequence of the resultant inflation in the rents of utilities-included units, and counted again as a consequence of the resultant increase in their out-of-pocket expenses on utilities.

[6] Prior to 2003, the water and sewer adjustment was a constant value over time. In 2003, the amount was updated, and afterwards was adjustment monthly to reflect changes.

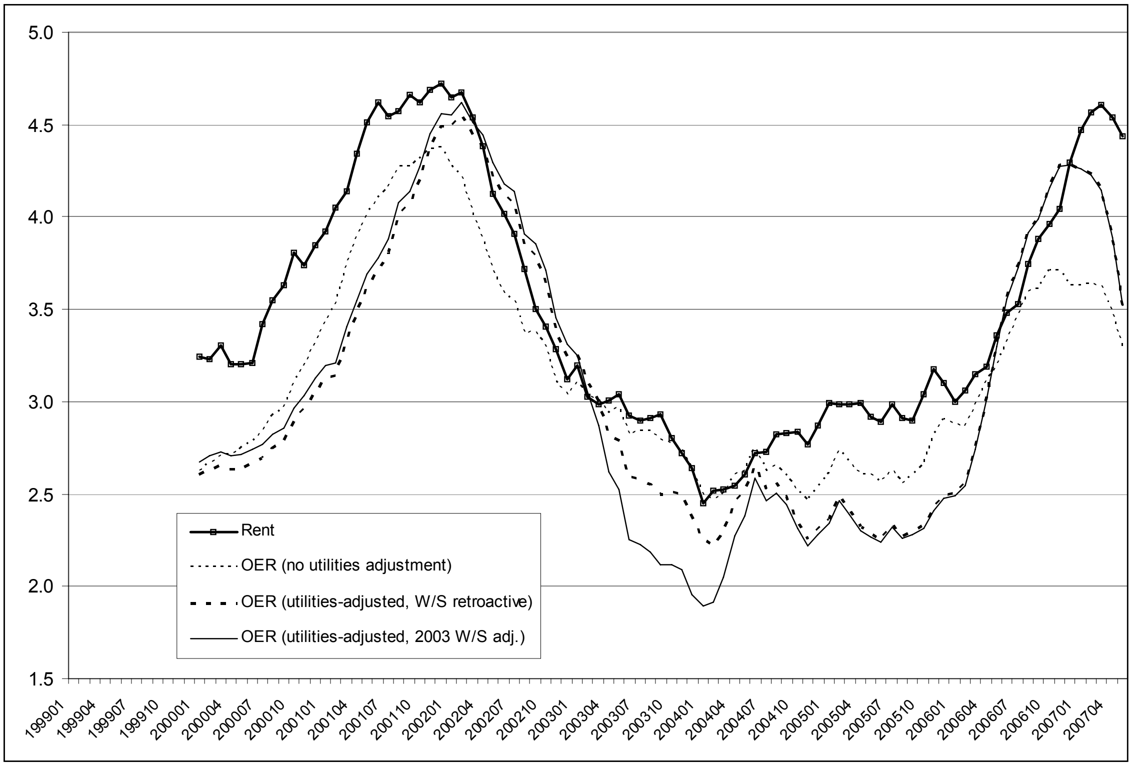

Figure 2: Impact of Utilities Adjustment

The difference between the published OER series, i.e. "OER (utilities adjusted, 2003 W/S adj.)," and the OER with retroactive water/sewer, i.e. "OER (utilities-adjusted, W/S retroactive)," is the impact of the one-time water-sewer adjustment improvement which was made in 2003. Clearly, this had a major impact on OER in that year. The water/sewer utilities adjustment was actually fairly modest, but it decreased – by a very small percentage – nearly *all* utilities-adjusted (OER) rents for a six-month period. This effectively reduced 12-month OER inflation by 0.3% in 2003. Note from Figure 2 that, had this improvement been continuously implemented since 1999, its impact on the OER index would have been trivial.

The difference between the "OER (utilities-adjusted, W/S retroactive)" series and the "OER (no utilities adjustment)" is the remaining (non-water/sewer) impact of the utilities adjustment. How much of the OER-Rent inflation divergence is due to the utilities adjustment? Contrary to popular opinion, it is no smoking gun. Regarding the impact of the utilities adjustment, five distinct periods can be discerned: 2000:01-2001:12; 2002:01-2003:02; 2003:03-2004:06; 2004:07-2006:04; and

2006:05-2007:05. Only during the third period, 2003:03-2004:06 (the water/sewer episode), does the utilities adjustment "explain" the observed divergence between OER and Rent inflation. The utilities adjustment does not account for even half of the divergence during the first period, and only about half during the fourth period. During the second and last of these periods, 2002:01-2003:02 and 2006:05-2007:05, the utilities adjustment actually *reduced* the divergence between Rent inflation and OER inflation – sometimes by very considerable amounts. (The fact that each of the factors investigated has the potential to increase or decrease divergence also implies that there is no unambiguous way to attribute a particular percentage divergence between OER inflation and Rent inflation to different causes.)[7]

It is easy to misinterpret these divergences, particularly with respect to their timing. We here remind the reader that we are considering 12-month changes in indexes which are themselves constructed on the basis of 6-month changes. The 6-month inflation in utilities does not translate directly and immediately into a given "impact of utilities" on 12-month OER inflation. For example, upon examining higher-frequency changes in the above indexes,[8] it is evident that the large utilities adjustments driving the 12-month-inflation divergence between OER and "OER (no utilities adjustment)" in late 2006-early 2007 actually stem from early-to-mid 2006. Furthermore, as explained in Verbrugge (2007b), the relationship is nonlinear; the influence of utilities inflation upon divergence depends not only upon the relative importance of utilities in rent, but also upon its inflation relative to inflation in rent-of-shelter. (For example, if utilities inflation is only slightly positive but rent inflation is robustly positive, then OER inflation will exceed inflation in "OER (no utilities adjustment).")

Thus, the utilities adjustment *can* have a significant impact on the aggregate (and even more so in the Northeast and Midwest indexes, as we demonstrate below.) But eliminating the effects of this adjustment results in an OER inflation series that still displays significant divergence from the Rent inflation series, for most time periods. There is much more to the story than simply utilities.[9]

[7] On average, if one uses the metric $\frac{1}{T}\sum_{j=1}^{T}\frac{\left|OER^{no\ helpers}-OER^{no\ helpers,\ no\ util.\ adj.}\right|_j}{\left|Rent-OER\right|_j}$, the utilities adjustment accounted for 25% of the inflation divergence.

[8] We thank Brian Sack of Macroeconomic Advisers, whose feedback and questions encouraged us to report this.

[9] Recall that the rent series is not a pure shelter series, since it also includes utilities – due to the presence of rental contracts which include utilities. Both the rent and OER series include the services of consumer durables like refrigerators, as these are typically included in all rental contracts.

And what is the rest of the story? As noted above, differential inflation experienced by different segments of the rental market. To demonstrate this, we first consider a sequence of adjustments which move the experimental OER measures closer to Rent; then finally, we remove the Rent units unique to Rent, in order to elucidate the impact of rent-control units.

3 Factors 2 and 3: Weights on Uncontrolled Units

Recall that OER indexes and Rent indexes are both constructed using (1), but each is constructed using different weights; some OER units receive zero Rent-weight (and vice versa), and most units receive differential weight. This section explores the impact of removing the units unique to OER (factor 3) – while maintaining the OER-Rent weight differential – and then of changing the weights used in (1) from OER weights to Rent weights (factor 2). (Recall that weights-related factors will be important only to the extent that different segments of the rental market experience different inflation rates.) Note that – since we wish to isolate the effect of changing weights – from here until Section 6, none of the experimental OER-type series have utilities adjustments; in other words, if utilities are included in the rental contract, they are included in the rent measures used in (1).

Figure 3 below plots four series: Rent, and three experimental OER-type series. In reverse order, the last of these is the experimental OER series mentioned in the previous section, i.e. OER without any utilities adjustments. The second is an experimental OER series which is constructed using only units common to both the OER and Rent indexes; in other words, no "helper segment" units which are unique to the OER index are included. However, this index continues to use OER weights in (1) when constructing Elementary Indexes. The first index is identical to the second one, except that it constructs the Elementary Indexes using *Rent* rather than OER weights. (For all the OER series depicted, aggregation of the "OER" indexes to the national index is conducted using OER weights.)

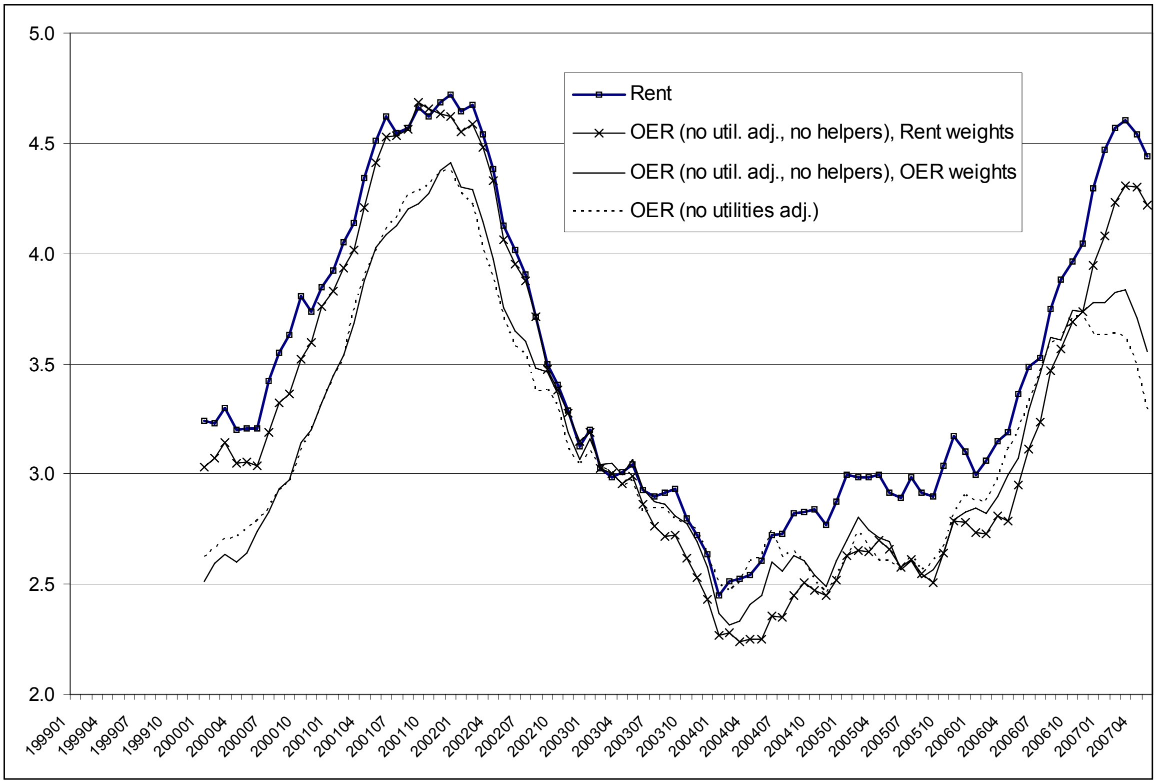

Figure 3: Helpers, OER vs. Rent Weights

First, how much of the divergence is due to the presence of helper segments? As can be seen from the change in going from "OER (no utilities adjustment)" to "OER (no util. adj.), OER weights," only rarely do helper segment units experience inflation different from other units with large OER weight. The exceptions: in the first half of 2004, helper segment units experienced higher inflation, causing a gap of 0.15% on average; and in the first five months of 2007, helper units experienced lower inflation, causing a gap of 0.21% on average.

Second, how much of the divergence is due to different weights applied to units *common* to both Rent and OER?[10] Here is one of the big surprises. Rent inflation was often *quite* different across different segments of the market within metropolitan areas. In particular, until mid-2003, the inflation experienced by units with larger OER weight was lower than that experienced by units with larger Rent weight. Subsequently, this differential reversed, and high-OER-weight units

[10] In point of fact, there are some units which are not common; in particular, there is a small fraction of non-rent-control units in Rent which receive zero weight in OER.

experienced higher inflation for a time. After 2004, these inflation rates became roughly equal until the end of 2005, when again, units with higher OER weight experienced somewhat higher inflation. This ended in late 2006, and subsequently high-Rent-weight units experienced *considerably* higher inflation.[11,12]

In sum, there are three periods during which factor 3 is dominant. First, during the early part of the period, between 2000:01 and 2002:09, different weights in (1) were responsible for the *vast majority* (about two-thirds) of the divergence between 12-month inflation in Rent versus in OER. In particular, the units weighted more heavily by the Rent index experienced greater inflation; moving from OER to Rent weights leads to an increase of 0.35% in inflation over this period. Conversely, starting in 2003, units weighted more heavily by the Rent index experienced somewhat *lower* inflation; moving from OER to Rent weights leads to an average decrease of 0.1% in inflation over this period.[13] Finally, in late 2006, moving from OER to Rent weights leads to a considerable increase in inflation. Indeed, by 2007:5, there is a full percentage point difference attributable to differential inflation in market rents within metropolitan areas (factors 2 and 3). (We find that in mid-2007, within-metro-region inflation differentials caused OER-Rent inflation differentials of this sign and about this magnitude in: three of the four Census regions; practically every metropolitan area in the Northeast; medium-sized cities in the South; and, in Chicago, for a stunning inflation differential of about 3% – which rebuts claims that Manhattan was driving the US differential.) We note that the rental vacancy rate remained essentially flat between 2005:I-2007:I, while the homeowner vacancy rate climbed 55% over this period,[14] and the homeownership rate fell modestly.

[11] The goal is to isolate the impact of changing weights in (1). Above, we did this using rent measures appropriate for constructing Rent, namely measures with utilities included. But we could equally well have, instead, used rent measures appropriate for constructing OER, namely measures with utilities *removed*. As a robustness check, we thus applied an experimental utilities-adjustment procedure suggested by Verbrugge (2007b) to rents, and used these utilities-adjusted rents in (1), changing only the weights. Results are basically unchanged.

[12] Looking at 12-month inflation rates obscures the timing of the divergence; inflation in high-OER-weight units actually began to decline in the third quarter of 2006, while inflation in high-Rent-weight units did not begin to decline until the first quarter of 2007.

[13] Verbrugge et al. (2007) found that the influence of block-group-percent-renter was statistically-significant and generally negative when considering 2001-2004 rent growth (a span which crosses two of these periods). That study is not directly comparable, however, because it did not consider aggregation weights (i.e., it implicitly assigned an equal weight to each rental unit). Furthermore, despite high correlation, there is not a direct mapping between percent-renter and Rent weight.

[14] Wheaton and Nechayev (2006) note that the share of house purchases for second home or investment purchases has increased sharply since 1999, and that small movements in the homeowner vacancy rate have a major impact on housing prices.

4 Factor Five: Upper-Level Aggregation Weights

Regional and National Indexes are weighted averages of Elementary Indexes. Different metropolitan areas can experience different shelter inflation rates. This can affect the OER and Rent indexes differently, because some cities are much more renter-intensive than others, and thus receive higher weight in regional or national Rent indexes. In this Section, we demonstrate the impact of this factor.

Figure 4 below plots three series: Rent, and two experimental OER-type series. In reverse order, the last of these is the aforementioned experimental OER series with no utilities adjustment, no helper-units, constructed with Rent weights, but using OER weights for aggregating the "OER" indexes into a national index. The second is identical, except that it uses *Rent* weights for aggregating the "OER" indexes into a national index.

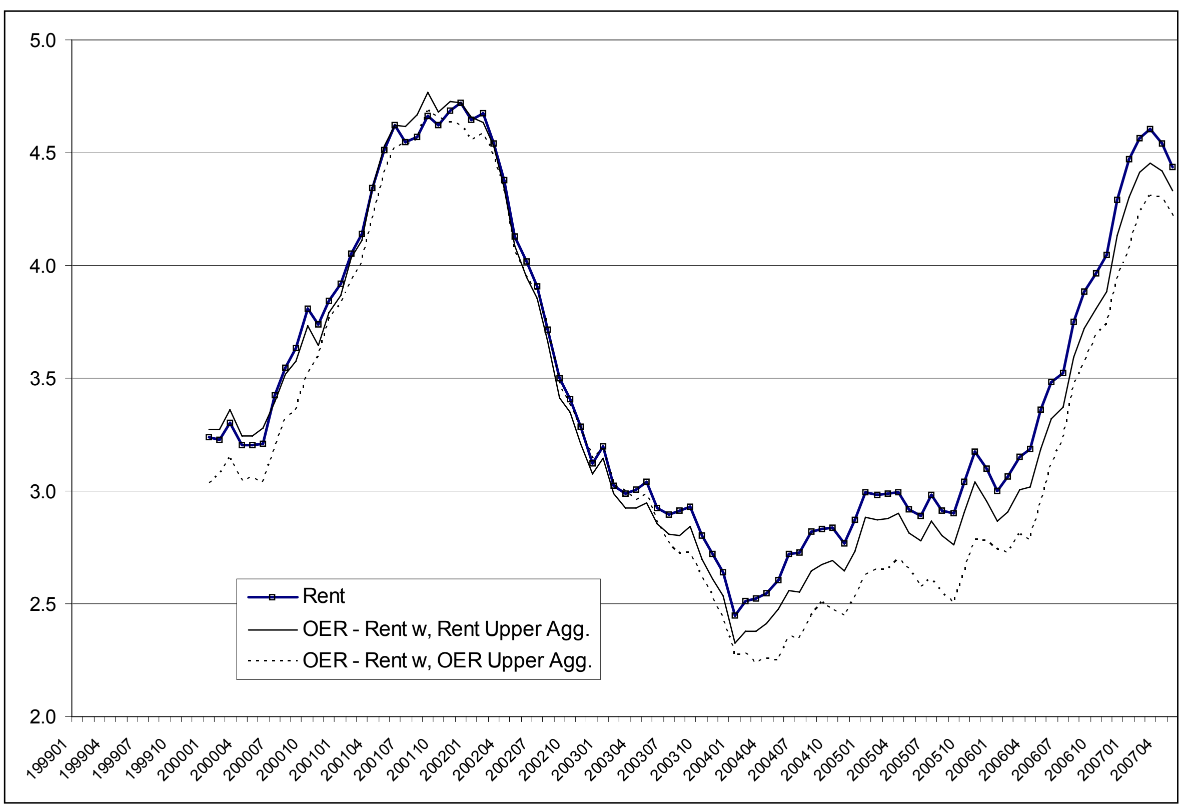

Figure 4: Upper-Level Aggregation Weights

How much of the divergence is due to the different upper-level aggregation weights? There are two periods during which this had a fairly significant impact on the aggregate index. In 2000, upper-level aggregation weights accounted for a difference of about 0.25%, representing about one-third of the divergence between Rent inflation and OER inflation. Similarly, after 2003, this accounted for an average increase of about 0.20%, which again puts it in the ballpark of about one-third of the divergence.

5 Factor Four: Rent Control

The experimental OER index "OER - Rent w, Rent Upper Agg." and the Rent index are nearly identical, except for factor 4: there are some units – namely, rent-regulated units – which are used in (1) for constructing Rent indexes, but are excluded from OER indexes. Surprisingly, these units had a sizable impact on the aggregate.

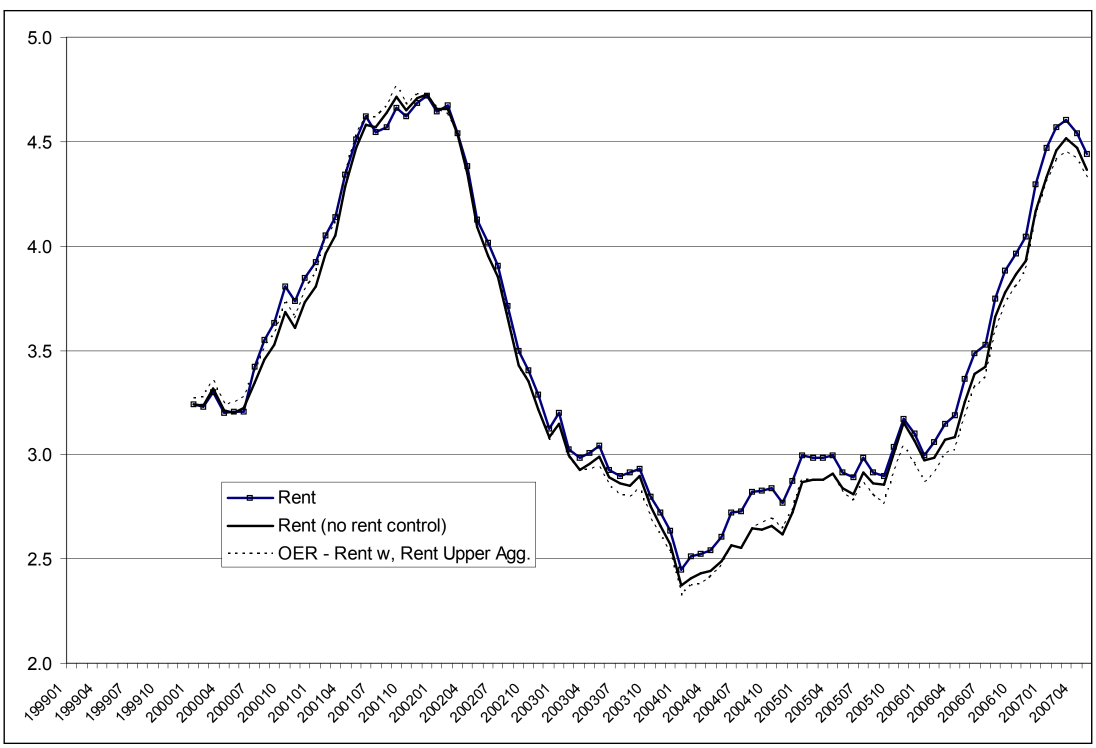

Figure 5: Rent Control

Investigating the Rent-OER Inflation Divergence

During the latter part of the period – and in particular, during 2004 (and, to a lesser extent, between 2000:06-2001:06, and after 2005) – this regulated sector of the economy experienced greater rent inflation, contributing almost 0.2% to inflation in the Rent index. This is somewhat of an empirical puzzle. While most rent-control regimes in the US are so-called "second-generation" regimes (see Arnott, 1998) which are more moderate than the textbook price ceiling version, they do nonetheless place restrictions upon rent inflation (generally based upon aggregate CPI inflation). Furthermore, most rent-control regimes allow landlords to set nominal rents freely when taking on a new tenant, so that these units will experience rapid inflation upon turnover. But this would likely lead to rent inflation which – over long periods – would *equal* market rent inflation.[15] This is consistent with most of the available evidence (see Turner and Malpezzi (2003) for a survey of the empirical research). For example, Olsen (1997) and Pollakowski (1997) studied rent-control in NYC, and Schneider et al. (1999) studied rent-control in DC; each study came to the conclusion that rents on most rent-controlled units are similar to other rents. We tentatively hypothesize that above-average rent inflation in rent-control units reflects "catching up to market rents." Alternatively, a steady flow of units coming *off* of rent control might also explain this: if a unit comes off rent-control between $t-6$ and t, it remains flagged as a rent-control unit for the purposes of constructing period-t rent relatives.

The fact that rent control in only three metropolitan areas can impact aggregate US rent inflation is quite surprising, and perhaps is partly responsible for the puzzling unresponsiveness of rents that has been highlighted in, e.g., DiPasquale and Wheaton (1992) and Blackley and Follain (1996). A shock to user costs or to shelter demand in a city would presumably impact market-based rents as soon as contracts are renewed, but would presumably only influence rent-controlled rents after a longer lag, which would partly explain the rent inflation stickiness highlighted by Verbrugge (2007a,c).

Before proceeding to the investigation of the Rent-OER divergence in the four Census regions, we discuss the impact of two remaining minor differences between Rent and OER.

[15] Most of the rent control regimes in place in the US are termed "tenancy rent control" by Basu and Emerson (2000), which have the character described above: they allow landlords to set a nominal rent freely when taking on a new tenant, but place restrictions on rent inflation for existing contracts. In particular, these authors argue that the rent control regimes in Los Angeles, Berkeley, and New York City all have this character.

Two remaining minor differences

1. *Imputation of missing rents.* When a rent quote is not collected from a particular unit in a given time period, there is an imputation procedure which "fills in" a rent estimate that can be used later on, if a rent quote does become available six months hence. This procedure estimates an inflation rate for the unit, based upon the inflation experienced by similar units. This imputation is done using all the data available to the BLS, but since OER inflation and Rent inflation can differ, the imputed "Rent" value for a particular unit can differ from the imputed "OER" value. Consistency requires that when we use Rent weights in (1), we use Rent imputes. (Note that imputations of this sort can only have a short-run impact on the index; overall index movements are driven by actual rent quotes.)

2. *Changes in the provision of utilities for Rent.* If there are *changes* in the provision of utilities in a rental contract, utilities-provision adjustments are made for the rent measures entering Rent indexes. (These have no impact on OER, since utilities are always removed in any case.) The utilities included or excluded from the contract do not often change, and hence the effect of these changes are small. We found that making these utilities-provision adjustments explained nearly all of the remaining differences.

6 Regional Decompositions

In each region, within-metro-area rental market segmentation played a key role, but the remainder of the story differs by region. Accordingly, in order to limit the number of Figures and enhance their clarity, in each region we omit plotting one or more of the series studied above, whenever the corresponding factor's role is limited.

6.1 Northeast

Figure 6a plots four series for the Northeast region. The first is Rent without rent control units, and the remaining three are OER-based indexes. In reverse order, the last of these is OER (with the retroactively-applied water/sewer improvement); the second is OER without any utilities adjustment; and the first is OER without utilities, using Rent weights but OER upper-level aggregation. In this region, helper-unit inflation was only occasionally very different from other units with large OER weight, hence we omit the series "OER (no util. adj., no hlpr, OER w, OER agg.)" to avoid cluttering up the Figure.

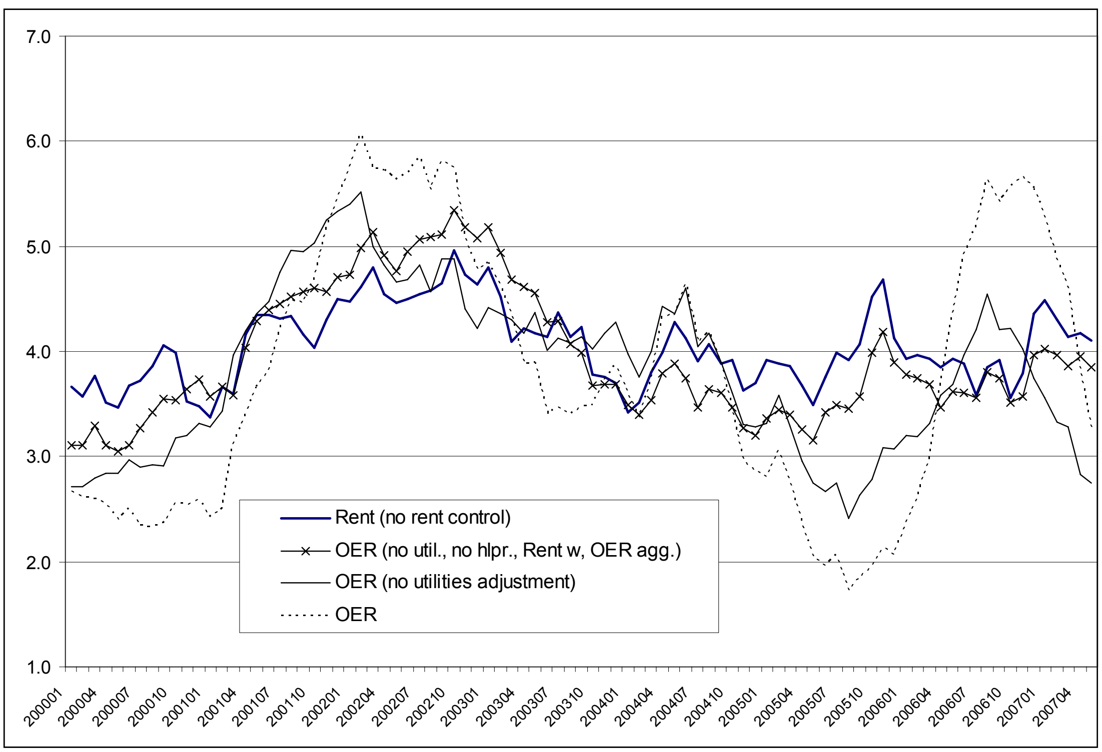

Figure 6a: Northeast, Utilities and Aggregation Weights

Several factors played a noticeable role in the Northeast: utilities, within-metro-area rental market segmentation, across-metro-area shelter inflation divergence, and rent control.

The difference between "OER" and "OER (no utilities adjustment)" is due to the utilities adjustment. Utilities adjustment obviously plays a large role in this region, a region in which the majority of rental units have heat included in the rental contract. But surprisingly, even in this region, most of the time the utilities adjustment does not account for the majority of the divergence between Rent inflation and OER inflation. The difference between "OER (no utilities adjustment)" and "OER (no util. adj., no hlpr, Rent w, OER agg.)" is due to changing from OER weights to Rent weights in (1). This frequently has a sizable impact (positive or negative), especially after 2005:03; again, this reflects different inflation rates experienced by different segments of the rental market within a city. The difference between "OER (no util. adj., no hlpr, Rent w, OER agg.)" and "Rent (no rent control)" is due to switching from OER weights to Rent weights in upper level aggregation. This also plays a significant role for many periods; New York City has a disproportionate impact owing to its high intensity of renters.

As noted above, in 2007:05 the divergence between 12-month OER and Rent inflation, once the effect of utilities is accounted for, is substantial.

What remains to be depicted is the impact of rent-control units. Figure 6b accordingly plots two series, Rent without rent-control units, and Rent.

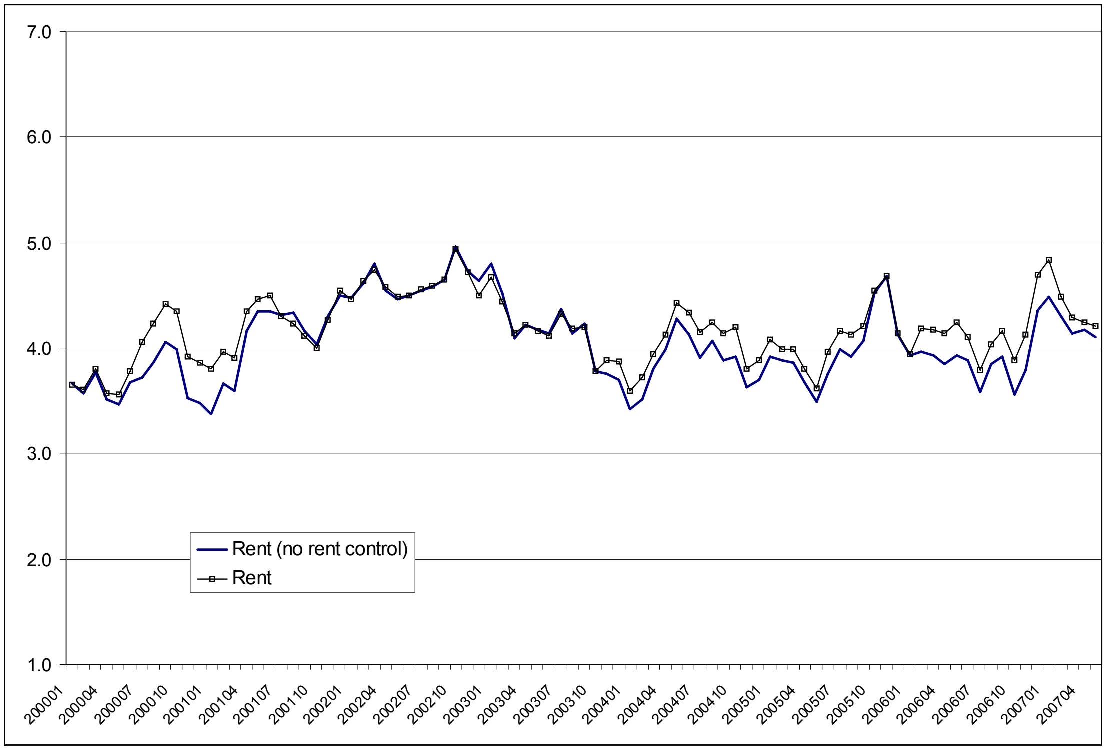

Figure 6b: Northeast, Rent Control

It is clear that rent control had a noticeable impact on Rent inflation in the Northeast over this period. During the 9-month period between 2000:07-2001:03, inclusion of rent-controlled units increased annual Rent inflation by nearly 0.4%. Between 2004:01-2005:09 and in 2006, their inclusion raised annual Rent inflation by about 0.2%.

In greater New York City, the impact was obviously even greater: their inclusion contributed almost 0.7% to Rent inflation between 2000:07 and 2001:03; and on average over the entire period, it contributed slightly more than 0.2% per year to this metropolitan region's Rent inflation. The positive average impact of rent control on Rent inflation was mostly due to a positive average impact in New York City itself; inclusion of rent-controlled units had an average impact of roughly 0% in its New York-Connecticut suburbs, and an average impact of -0.1% in its New Jersey suburbs.

6.2 Midwest

Figure 7 plots four series for the Midwest region: OER (with the retroactively-applied water/sewer improvement); OER without any utilities adjustment; OER without utilities, using OER weights and OER upper-level aggregation; and Rent. For this region, we do not plot the series "OER (no util., no hlpr., Rent w, OER agg.)." Prior to 2002, moving from OER to Rent upper aggregation weights reduced inflation by an average of 0.15%; but afterward, this factor played only a very modest role. Accordingly, factor 2's impact is more-or-less seen in moving from "OER (no util., no hlpr., OER w, OER agg.)" to "Rent."

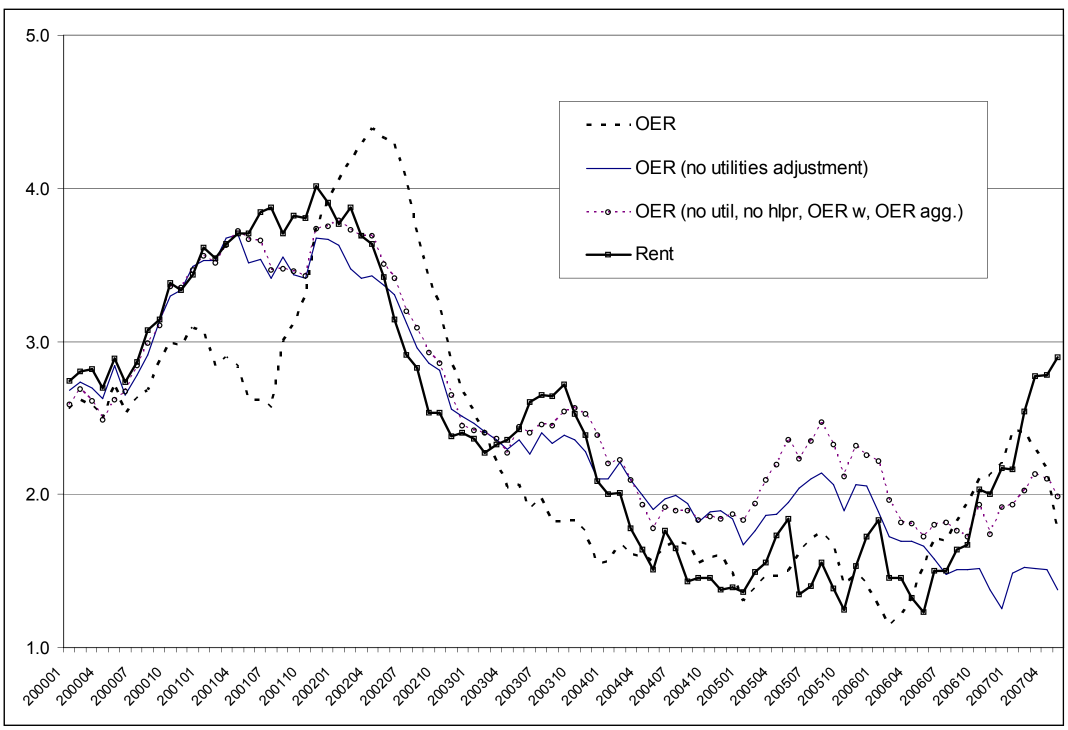

Figure 7: Midwest

The story in the Midwest is utilities plus within-metro-area rental market segmentation.

The difference between "OER" and "OER (no utilities adjustment)" is due to the utilities adjustment. Its impact was often quite large in the Midwest during this period, reflecting the large percentage of rental units which have heat included in the rental contract. (Notice that later in the period, the utilities adjustment *reduced* rather than increased the divergence between Rent and OER inflation.) The difference between "OER (no utilities adjustment)" and "OER (no util., no hlpr., OER w, OER agg.)" is due to factor 2, removing helper segments; and the difference between "OER (no util., no hlpr., OER w, OER agg.)" and Rent is essentially attributable to factor 3. Thus, after considering the effect of utilities, within-metro-area rental market segmentation – i.e. moving from OER weights to Rent weights in (1), and addressing helper-unit inflation – is essentially the rest of the story. After 2004, inflation in helper units began to fall below inflation in other high-OER-weight units, particularly after mid-2006. By 2007:5, it accounted for fully half of the extremely large (1.5%) gap between inflation in utilities-included OER and inflation in Rent.

6.3 South

Figure 8 plots four series for the South region: Rent, OER without utilities, using Rent weights and OER upper-level aggregation, OER without utilities, using OER weights and OER upper-level aggregation, and OER (with the retroactively-applied water/sewer improvement). We do not plot the series "OER (no utilities adjustment);" in this region, the utilities adjustment plays very little role, which is not surprising since only a small percentage of rental units include energy utilities in the contract.

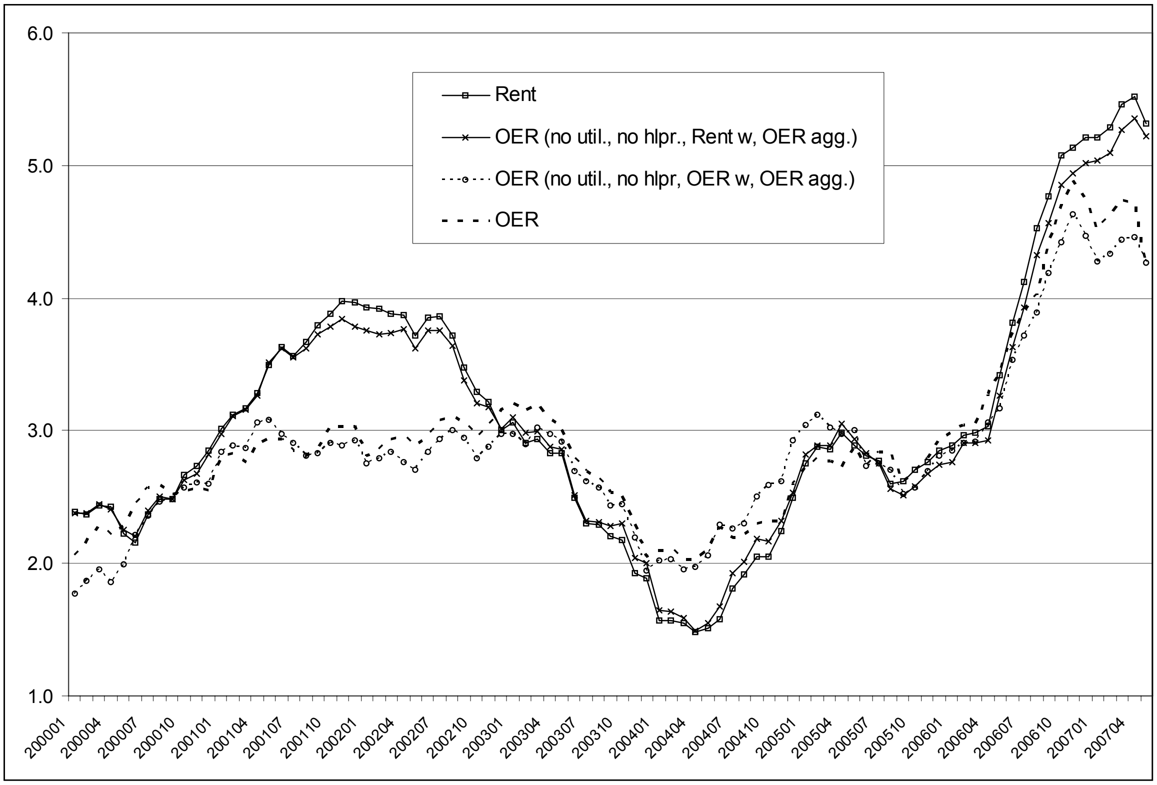

Figure 8: South

In the South, the story is particularly simple: within-metro-area rental market segmentation (and in particular, factor 2: weights on common units). The difference between "OER" and "OER (no util., no hlpr., OER w, OER agg.)" is due to removing helper segments. This exerts a small influence from time to time, but whenever there is a significant gap between OER and Rent inflation, factor 2 – which drives the gap between "OER (no util., no hlpr., OER w, OER agg.)" and "OER (no util., no hlpr., Rent w, OER agg.)" – is the basic explanation.(Upper level aggregation, which is responsible for the gap between "OER (no util., no hlpr., Rent w, OER agg.)" and "Rent," exerts a small influence from time to time.) As noted above, in 2007:05 the divergence between 12-month OER and Rent inflation is substantial.

6.4 West

Figure 9 plots four series for the West region: Rent, Rent without rent control units, OER without utilities or helpers, using Rent weights but OER upper-level aggregation, and OER (with the retroactively-applied water/sewer improvement). As for the South, we do not plot the series "OER (no utilities adjustment);" in the West, the utilities adjustment plays very little role, because only a small percentage of rental units include energy utilities in the contract. As helper unit inflation is very similar to the inflation in other high-OER-weight units in this region, we also do not plot the series "OER (no util., no hlpr, OER w, OER agg.)."

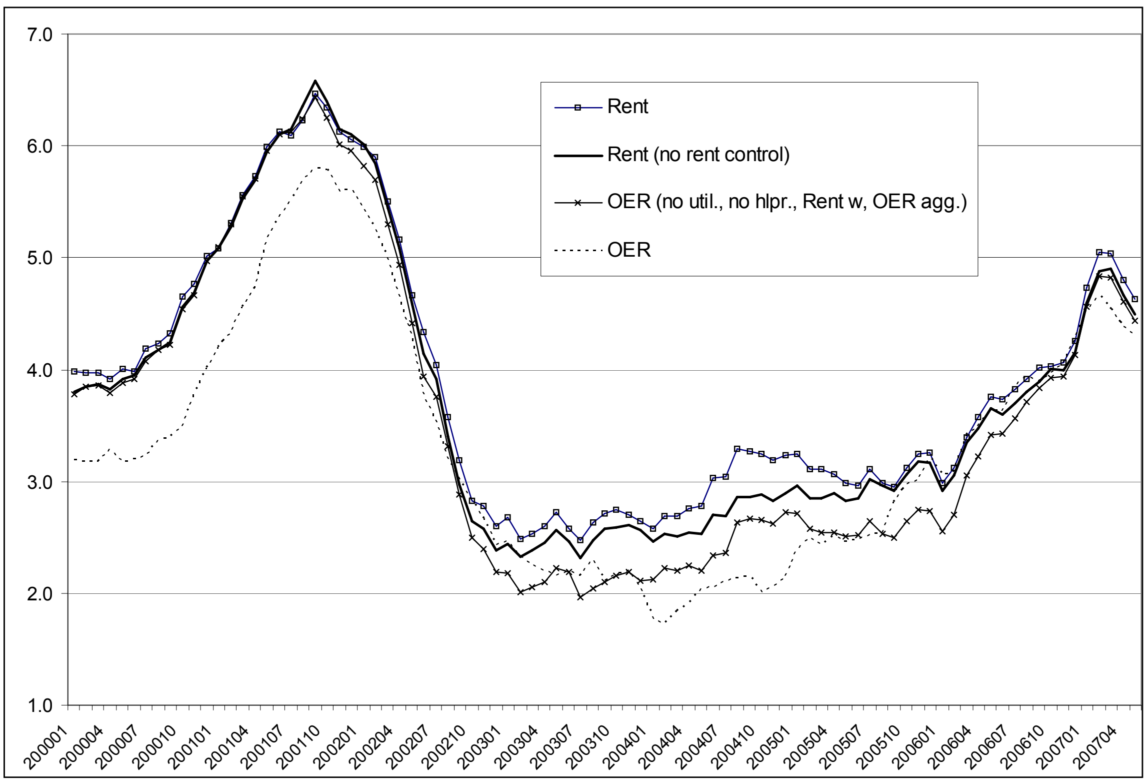

Figure 9: West

The the West, three factors played a role in explaining Rent-OER inflation divergence: rent control, across-metro-area shelter inflation divergence, and within-metro-area rental market segmentation.

First, rent control – responsible for the gap between "Rent" and "Rent (no rent control)" – had an important impact on Rent inflation in this region. Inflation in rent-regulated units exceeded that in other units, and hence their inclusion increased rent inflation fairly significantly between 2002:10-2005:6. (In Los Angeles and in the greater San Francisco region, rent control had an enormous effect. In Los Angeles, between 2004:04 and 2005:06, inflation in rent-control units increased Rent inflation by nearly 1%; on average over the entire period, inflation in these units increased Rent inflation by 0.4%. In fact, rent-control only *decreased* Rent inflation in Los Angeles for one short period, between 2005:08 and 2006:02. In the greater San Francisco region (which includes Oakland and San Jose), rent control had equally large effects, but these oscillated between ±1%, with an overall average of 0.3%.)

Second, switching from Rent to OER weights in the upper level aggregation – i.e., moving from "Rent" to "OER (no util., no hlpr, Rent w, OER agg.)" – also plays a significant role between 2003 and 2006. This undoubtedly reflects the fact that beginning in 2002, greater Los Angeles, a renter-intensive region, experienced much higher rent inflation than did the average city in the West.

Finally, as in each of the other regions, within-metro-area rental market segmentation played an important role. Moving from Rent weights to OER weights in (1) – the difference between "OER (no util., no hlpr, Rent w, OER agg.)" and "OER" – frequently has a sizable impact; this is particularly notable prior to 2002:06 (during which time this factor is essentially the entire story), and in 2004. (Conversely, in the period 2005:08-2006:06, using Rent weights would have increased the divergence between OER and Rent inflation.)

7 Conclusion

While the utilities adjustment sometimes has a quantitatively-significant impact on the OER indexes – as it should – it is by no means the entire explanation of the divergence between OER inflation and Rent inflation between 1999 and 2006. (Indeed, this adjustment reduced divergence between these two series almost as often as it increased it.) Instead, rental market segmentation – different rent inflation rates were experienced by different parts of the rental market – also played a key role.

In particular, between 2000:1 and 2002:09, the Rent-OER inflation divergence mainly resulted from divergent rental inflation rates *within* metropolitan areas: areas with a higher proportion of renters experienced higher rental inflation. The differential impact on Rent inflation was about 0.35%. (For more evidence on this issue, see the study of Verbrugge et al., 2007). Differential shelter inflation *across* metropolitan areas played a key role in the Rent-OER divergence in 2000 and after 2004, accounting for almost one-third of the divergence; in 2007:05, this factor's importance is overwhelming. And – most surprisingly – during 2004, higher inflation in rent-control units in the Northeast and West caused overall Rent inflation to rise by about 0.2%.

The BLS constructs separate indexes for Rent and for OER. An alternative approach – one which is already in implicit use in many real estate studies – would be to control for the effect of utilities and rent control, but otherwise use identical weights to construct Rent and OER indexes. The analysis above demonstrates the shortcomings of this alternative. Clearly, rental markets *are* segmented to an appreciable extent along the Rent weight-OER weight dimension, and can experience distinctly different inflation rates. The observed divergence between OER and Rent inflation – particularly once this effect is identified as above – highlights this segmentation, and is a key empirical finding which requires explanation. We do not attempt such an explanation here, but leave it for future research.

Finally, there is no reason to expect that Rent and OER inflation will not diverge again in the future.

8 References

Arnott, Richard J. (1998) "Rent Control," in *The New Palgrave Dictionary of Economics and the Law, vol 3.*, Ed. Peter Newman (New York: Stockton Press), 305-310.

Basu, Kaushik, and Patrick Emerson (2000) "The economics of tenancy rent control." *The Economic Journal* 110, 939-962.

Blackley, Dixie M., and James R. Follain (1996) "In search of empirical evidence that links rent and user cost," Regional Science and Urban Economics 26, 409-431.

Calhoun, Charles A. (1996) "OFHEO House Price Indexes: HPI Technical Description." Manuscript, OFHEO.

Crone, Theodore, Leonard Nakamura and Richard Voith. (2006) "Rents have been rising, not falling, in the postwar period." Manuscript, Federal Reserve Bank of Philadelphia.

Diewert, Erwin (2003) "The Treatment of Owner Occupied Housing and Other Durables in a Consumer Price Index." Manuscript, University of British Columbia.

DiPasquale, Denise, and William C. Wheaton (1992) "The Costs of Capital, Tax Reform, and the Future of the Rental Housing Market," Journal of Urban Economics 31, 337-359.

Genesove, David (2003) "The Nominal Rigidity Of Apartment Rents," *Review of Economics and Statistics*, 85.4, 844-853.

Gallin, Joshua, and Randal Verbrugge (2006) "Features of Rent Changes that You Want to Know About." Manuscript in preparation, BLS.

Gallin, Joshua, and Randal Verbrugge (2007) "Improving the CPI's Age-Bias Adjustment: Leverage, Disaggregation and Model-Averaging." Manuscript, BLS.

Levinson, Arik, and Scott Niemann (2004) "Energy Use By Apartment Tenants When Landlords Pay For Utilities," Resource and Energy Economics, 26.1, 51-75.

Maki, Dean, and Julia Coronado (2007) "Market Strategy Americas: US Economic Outlook," Barclay's Capital Research Note, May 17, 2007.

Olsen, Edgar O. (1997) "The Impact of Vacancy Decontrol in New York City: The First Estimates from the 1996 Housing and Vacancy Survey." Report, New York City Rent Guidelines Board.

Pollakowski, Henry O. (1997) "The Effects of Partial Rent Deregulation in New York City." MIT Center for Real Estate.

Ptacek, Frank, and Robert M. Baskin (1996) "Revision of the CPI Housing Sample and Estimators." Monthly Labor Review (December), 31-39.

Schneider, Stephen, Paul Bourquin,Stephen Malpezzi and Lisa Johnson. (1999) The Likely Impacts of Rent De-Control on District of Columbia Residents. Report to the District of Columbia Financial Responsibility and Management Assistance Authority, October 22,1999.

Turner, Bengt, and Stephen Malpezzi (2003) "A Review of Empirical Evidence on the Costs and Benefits of Rent Control." Manuscript, University of Wisconsin, Madison.

Verbrugge, Randal (2007a) "The Puzzling Divergence of Rents and User Costs, 1980-2004." Manuscript, BLS.

Verbrugge, Randal (2007b) "Do the CPI's Utilities Adjustments for OER Distort Inflation Measurement?" Manuscript, BLS.

Verbrugge, Randal (2007c) "Investigating the Rent-User Cost Paradox." Manuscript, BLS.

Verbrugge, Randal, Alan Dorfman, William Johnson, Fred Marsh III, Robert Poole, and Owen Shoemaker (2007) "Determinants of Rent Changes: Location, Location, Location?" Manuscript, BLS.

Wheaton, William C., and Gleb Nechayev (2006) "Past Housing 'Cycles' and the Current Housing 'Boom:' What's Different This Time?" Manuscript, MIT.