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An Investigation into Appraisal Bias: The Role of Decision Support Tools in Debiasing Valuation Judgments

O. Alan Tidwell

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Owen Alan Tidwell

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An Investigation into Appraisal Bias: The Role of Decision Support Tools in Debiasing Valuation Judgments

BY

OWEN ALAN TIDWELL

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ACCEPTANCE

This dissertation was prepared under the direction of the Owen Alan Tidwell Dissertation Committee. It has been approved and accepted by all members of that committee, and it has been accepted in partial fulfillment of the requirements for the degree of Doctoral of Philosophy in Business Administration in the J. Mack Robinson College of Business of Georgia State University.

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ABSTRACT

An Investigation into Appraisal Bias: The Role of Decision Support Tools in Debiasing Valuation Judgments

BY

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The real estate appraisal profession can be described as a business of systematically gathering, analyzing and interpreting information, typically culminating in the reporting of a valuation judgment (i.e. appraisal). Gallimore (1996) contends that appraisals are a function of the way in which appraiser's process information. Contrary to an efficient stock exchange, where a multitude of information is publicly available and a considerable number of homogenous transactions occur each day, the private real estate market historically has been characterized by high informational search cost, limited information, heterogeneous properties and relatively few transactions. In the recent past, commercial appraisers operated without a central data provider and were largely constrained to anecdotal approaches to gather market data, which often times resulted in an incomplete search for information. This deficit of market

information, which is central to the appraisal process, may manifest into a wide dispersion of possible market value estimates and lead to the use of heuristics or cognitive short-cuts depending on the type and amount of information obtained.

When conducting an appraisal assignment, the appraiser is charged with following an eight-step systematic appraisal process (the normative appraisal model) prescribed by the Appraisal Institute, a respected appraisal organization and leader in professional appraisal education. In practice, the application of the prescribed normative appraisal model is a time demanding and cognitively challenging process due to the complexity, volume and limited availability of the information to be collected. Simon (1957) contends that limits on the computational capacity of humans is a notable constraint upon rational decision makers (e.g. a person with complete knowledge, a stable system of preferences, and unlimited processing ability) and thus people exhibit "bounded rationality". Newell and Simon (1972) and Simon (1978) suggest that the processing limitations of human memory is constrained, and the greater the information to analyze the greater the constraints, often times resulting in decision making that is based on bounded rationality. The central theme of bounded rationality is that constrained cognitive processing capacity mandates the use of heuristics or cognitive simplification mechanisms involving the selective and undemanding use of readily available information to solve a problem.

In a number of ways the prescribed appraisal process correspond to the human problem solving information-processing model of Newell and Simon (1972) and Simon (1978). The systematic process provides a standardized model to apply when confronted with an appraisal task environment and forming the perception of the problem or problem space. Formal training in the prescribed appraisal process model assists in acquiring the skills needed to identify the task-relevant aspects of the appraisal task in order to move competently from problem perception to problem solution. However, the normative model fails to address the potential effects of the appraiser's interaction with the task environment, most notably in this study the role of an anonymous expert's opinion of value.

Given the nature of the valuation task environment appraisers are often made aware of previous value opinions rendered by appraisers, commonly in the form of an historic appraisal. And, because an appraisal task involves the rendering of market value, a hypothetical,

unobservable construct based on probabilities, direct feedback against this objective is typically not possible. Therefore, alternate signals derived from the task environment such as confirmation of previous appraised values may be employed, thereby potentially altering the appraiser's perception of the valuation objective leading to divergence from the normative model. Indeed, Diaz and Hansz (1997) and Diaz and Hansz (2001) illustrate appraiser susceptibility of this reference point in the real estate appraisal domain. The use of this heuristic is typically aimed at reducing cognitive search costs, however, the consideration of a previous value opinion is, of course, in contradiction to the appraisal normative model. However, the real estate behavioral literature suggests commercial appraisers have been susceptible to anonymous value opinions of experts, a clear deviation from the normative model, often times resulting in biased valuation judgments.

Recently, research programs have examined potential "debiasing" techniques to moderate or eliminate systematic biases which under certain conditions result from the use of heuristics. One approach to debiasing is through the use of decision support tools and informational displays. This approach is coined the "technologist" approach because it relies on technology external to the decision maker (Larrick, 2004). In recognizing that attention and processing ability are scarce resources of a decision maker, and that acquiring and processing information can be costly, the use of technology in the form of a decision support tool has the ability to reduce search and processing cost (Payne, Bettman, and Schkade, 1999). In the context of commercial real estate, the emergence of CoStar and other providers of real estate information and analytics now provide decision support tools for real estate professionals including appraisers. Conlisk (1996) suggests that a reduction in informational search and processing costs may lessen the decision makers' reliance on cognitive simplification mechanisms. Thus, technologist contend that through the use of external decision support tools, systematic bias in decision making can be subdued or eliminated and the decision making process can approach the normative standard.

The extent to which decision support tools reduce search cost is positively related to their effectiveness. Decision maker's strategies are adaptive and generally result in a strategy which maximizes accuracy while minimizing search cost (Einhorn and Hogarth, 1981; Payne 1982; Johnson and Payne, 1985). The use of external decision support tools can successfully eliminate

biases if they can be implemented with little cognitive effort. The use of CoStar as a decision support tool in the commercial valuation context is expected to reduce the costs associated with the application of the normative appraisal model, resulting in a reduction in cognitive effort; and therefore should be utilized as a potential debiasing tool.

The technologist view suggests that commercial appraisers' utilizing external decision support tools which contain readily available standardized data will result in appraisers having increased confidence in their valuation estimates due to a reduction in market uncertainties. This increase in confidence, results in appraisers who are less susceptible to non-sanctioned heuristic influence. Indeed, Levy and Schuck (1999) contend that access to comprehensive in-depth market information would increase appraisers' confidence in their initial value judgments and lessen the amount of potential heuristic influence. Additionally, Molloy and Schwenk (1995) find the use of information technology that allows for efficient scanning of data increases decision makers' confidence in their decisions.

This research will be the first to focus on decision support tools as a technique to eliminate systematic biases in the appraisal process. The study focuses on the value opinion of an anonymous expert as a source of potential bias, because the value opinion of an anonymous expert is a common non-sanctioned source of influence representing a clear departure in the normative appraisal process. Also expert value opinions exerted the least amount of influence on appraisers, although still statistically significant, compared to other tested reference points (Diaz and Hansz, 2001). Therefore, the efficacy of decision support tools in debiasing valuation judgments is likely to be highest for groups receiving expert value opinions as a treatment.

To operationalize the research hypotheses a two-factor randomized experiment to investigate the stated research hypotheses was conducted. One of the factors of interest is the impact of a previous value judgment of an anonymous expert on the appraisal process. The factor is received at three-levels: (high, low, and no reference point). The reference point (anonymous expert's opinion of value) was administered to two broad groups (CoStar and NonCostar groups) of subjects comprising the second factor. The statistical procedures used in this study are the non-parametric Mann-Whitney U Test and the Kolmogorov-Smirnov (K-S) Test, and the parametric Analysis of Variance (ANOVA), and Student's t-test.

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Chapter One

Introduction

In this chapter, the general background, theoretical foundation, and importance of the study are discussed.

1.1 Background and Theoretical Foundation

The real estate appraisal profession can be described as a business of systematically gathering, analyzing and interpreting information, typically culminating in the reporting of a valuation judgment (i.e. appraisal). Gallimore (1996) contends that appraisals are a function of the way in which appraiser's process information. Contrary to an efficient stock exchange, where a multitude of information is publicly available and a considerable number of homogenous transactions occur each day, the private real estate market historically has been characterized by high informational search cost, limited information, heterogeneous properties and relatively few transactions. In the recent past, commercial appraisers operated without a central data provider and were largely constrained to anecdotal approaches to gather market data, which often times resulted in an incomplete search for information. This deficit of market information, which is central to the appraisal process, may manifest into a wide dispersion of possible market value estimates and lead to the use of heuristics or cognitive short-cuts depending on the type and amount of information obtained.

When conducting an appraisal assignment, the appraiser is charged with following an eight-step systematic appraisal process[1] (i.e. the normative appraisal model) prescribed by the Appraisal Institute, a highly respected appraisal organization and leader in professional appraisal

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[1] See Appendix 1 for an overview of the normative appraisal model

education.[2] In following the normative appraisal model, appraisers analyze the observed prices

of "comparables" or similar properties in the market and compare their attributes with those of

the subject property. Selection of comparables and subsequent adjustments are inter-related

activities, but ultimately lead to decisions or judgments which reflect the degree of reliance or

confidence placed upon individual pieces of evidence (Gallimore, 1996). The robustness of this

approach can be attributed to its efficiency and ease, providing sufficient available sample data.

This approach is applicable to all types of real estate; a series of steps is prescribed to ensure

appraisers follow a systematic procedure. Appendix 2 presents the five prescribed steps of the

sales comparison approach to value.

In practice, the application of the prescribed normative appraisal model is a time

demanding and cognitively challenging process due to the complexity, volume and constrained

availability of the information to be collected. Simon (1957) contend that limits on the

computational capacity of humans is a notable constraint upon rational decision makers (e.g. a

person with complete knowledge, a stable system of preferences, and unlimited processing

ability) and thus people exhibit "bounded rationality". Bounded rationality is the concept that

human decision-making is limited by available information, available time, and the information-

processing ability of the mind. Newell and Simon (1972) and Simon (1978) suggest that the

processing limitations of human memory is constrained, and the greater the information to

analyze the greater the constraints, often times resulting in decision making that is based on

bounded rationality.   The central theme of bounded rationality is that constrained cognitive

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[2] The Appraisal Institute's formulation of the normative model was a result of the Financial
Institutions Reform, Recovery and Enforcement Act (FIRREA) of 1989, contained in the Real
Estate Appraisal Reform Amendment or Title XI of Public Law 101-73

processing capacity mandates the use of heuristics or cognitive simplification mechanisms involving the selective and undemanding use of readily available information to solve a problem.

In a number of ways the prescribed appraisal process and the sales comparison procedure correspond to the human problem solving information-processing model of Newell and Simon (1972) and Simon (1978). The systematic process provides a standardized model to apply when confronted with an appraisal task environment and forming the perception of the problem or problem space. Formal training in the prescribed appraisal process model assists in acquiring the skills needed to identify the task-relevant aspects of the appraisal task in order to move competently from problem perception to problem solution. However, the normative model fails to address the potential effects of the appraiser's interaction with the task environment, most notably in this study the role of an anonymous expert's opinion of value. Indeed, research has shown that appraisers do not always follow the prescribed normative model (Diaz, 1990a) or the prescribed sales comparison procedure (Diaz, 1990b), particularly when they are aware of the pending sales price (Gallimore and Wolverton, 1997). Additionally, appraisers have been shown susceptibility to the influence of a variety of reference points.

While historically, there were minimum standards for recording publicly available real estate transactions, these standards and the amount of required public disclosure varied across localities. Access to this information is essential to the valuation process, but until recently informational access has been constrained by high search cost and the unreliability or availability of information[3]. Thus, commercial real estate appraisers may have been inclined to deviate from the prescribed normative appraisal process relying on short-cuts or heuristics, the use of which may lead to systematic biases when rendering valuation judgments.

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[3] Christopoulos, Jarrow and Yildirim (2008) discuss the recent availability of relevant historical real estate data.

Recently, research programs have examined potential "debiasing" techniques to moderate or eliminate systematic biases which often times result from the use of heuristics. One approach to debiasing is through the use of decision support tools and informational displays. This approach is coined the "technologist" approach because it relies on technology external to the decision maker (Larrick, 2004). In recognizing that attention and processing ability are scarce resources of a decision maker, and that acquiring and processing information can be costly, the use of technology in the form of a decision support aid has the ability to reduce search and processing cost (Payne, Bettman, and Schkade, 1999). In the context of commercial real estate, the emergence of CoStar and other providers of real estate information and analytics now provide decision support tools for real estate professionals including appraisers. Conlisk (1996) suggests that a reduction in informational search and processing costs may lessen the decision makers' reliance on cognitive simplification mechanisms. Thus, technologist contend that through the use of external decision support tools, systematic bias in decision making can be subdued or eliminated and the decision making process can approach the normative standard.

The extent to which decision support tools reduce search cost is positively related to their effectiveness. Decision maker's strategies are adaptive and generally result in a strategy which maximizes accuracy while minimizing search cost (Einhorn and Hogarth, 1981; Payne 1982; Johnson and Payne, 1985). The use of external decision support tools (e.g. CoStar) can successfully eliminate biases if they can be implemented with little cognitive effort. The use of CoStar as a decision support aid in the commercial valuation context is expected to reduce the costs associated with the application of the normative appraisal model, resulting in a reduction in cognitive effort; and therefore should be utilized as a potential debiasing tool.

Given the nature of the valuation task environment appraisers are subject to knowledge of anonymous expert's previous value opinion, typically in the form of an historic appraisal. And, because an appraisal task involves the rendering of market value, a hypothetical, unobservable construct based on probabilities, direct feedback against this objective is typically not possible. Therefore, alternate signals derived from the task environment such as confirmation of previous appraised values may be employed, thereby potentially altering the appraiser's perception of the valuation objective leading to divergence from the normative model. Indeed, Diaz and Hansz (1997) and Diaz and Hansz (2001) illustrate appraiser susceptibility of this reference point in the real estate appraisal domain. The use of this heuristic is typically aimed at reducing cognitive search costs, however, the consideration of a previous value opinion is, of course, in contradiction to the appraisal normative model. The appraiser's role is to render an unbiased and object value opinion while operating under the guidelines of the normative model and not simply validating previous value opinions. However, the real estate behavioral literature suggests commercial appraisers have been susceptible to anonymous value opinions of experts, a clear deviation from the normative model.

The technologist view suggests that commercial appraisers' utilizing external decision support tools which contain readily available standardized data on virtually all market sales will result in appraisers having increased confidence in their valuation estimates due to a reduction in market uncertainties. This increase in confidence, results in appraisers who are less susceptible to the influence of previous value opinions of anonymous experts. Indeed, Levy and Schuck (1999) suggest access to comprehensive in-depth market information would increase appraisers' confidence in their initial value judgments and lessen the amount of potential heuristic influence.

Additionally, Molloy and Schwenk (1995) find the use of information technology allowing for efficient scanning of data increases decision makers' confidence in their decisions.

The idea that appraisers lack confidence in their valuation judgments has been discussed in the real estate literature. Geltner (1989b) contends that appraiser's lack of confidence is a possible explanation of the appraisal smoothing phenomenon. The rational updating hypothesis formulated by Quan and Quigly (1991) suggests that appraisal smoothing exists because appraisers do not adequately update values because of poor market information, and due to the uncertainty of current market conditions attribute a function of the value to historic valuations. Diaz (1997) and Diaz and Hansz (1997) conducted a series of experiments examining the impact of previous expert value opinions on appraisal judgment and discovered no evidence that real estate appraisers operating in familiar geographic areas were influenced by the previous value estimates of anonymous experts. However, appraisers operating in unfamiliar areas were influenced by the valuation opinion of an anonymous expert. Diaz and Hansz, (1997) therefore argue their findings point to the conclusion that increased uncertainty may trigger the use of unsanctioned reference points (i.e. previous anonymous expert value opinions) which would otherwise be given little or no credence.

This research is structured around the debiasing potential of decision support tools recently made available in the commercial real estate appraisal profession. Decision support tools facilitate improved decision making by providing appraisers with more efficient access to reliable data than previously possible. The search cost for data in the private commercial real estate markets has been substantially lessened as a result of decision support tools such as CoStar.

1.2 Importance and Purpose of the Study

Market value estimation is inherently an imperfect and ill-structured process because it attempts to estimate a hypothetical value, i.e., the most probable price which a property should bring in a competitive market. An accurate, unbiased appraisal will increase the effectiveness of the appraisal user's decisions. However, the extant real estate behavioral literature is rich with studies providing evidence of systematic bias in the appraisal process. The present study, investigates the debiasing effect of decision support aids (tools) when used in the commercial appraisal process, and will build on existing behavioral appraisal research by introducing a potential debiasing technique to the real estate literature.

This research is the first to focus on decision support tools as a technique to eliminate systematic biases in the appraisal process. The study focuses on the value opinion of an anonymous expert as a source of potential bias, because the value opinion of an anonymous expert is a non-sanctioned source of influence representing a clear departure in the normative appraisal process. Also expert value opinions exerted the least amount of influence on appraisers, although still statistically significant, compared to other tested reference points (Diaz and Hansz, 2001) Therefore, the efficacy of decision support tools in debiasing valuation judgments is likely to be highest for groups receiving expert value opinions as a treatment.

Technological advances and the use of decision support tools has lead to change in virtually all business and industry sectors in recent years, and the real estate and appraisal industry are no exceptions. Historically, commercial appraisers operated in a domain with severe data limitations and information asymmetries. The data was asymmetric in that comprehensive standardized data information systems were not available to appraisers; as a

result appraisers were often relegated to rely on inefficient non-standardized methods to collect data which varied greatly among appraisers and appraisal firms. These methods placed reliance on the appraiser's ability to secure data from a disparate though related network of various real estate professionals through individual inquiry for each appraisal assignment. Often this method resulted in an incomplete search for data due to high search cost, leaving appraisers susceptible to the biasing effects of heuristic influence.

The findings of Diaz, Gallimore, and Levy (2004) illustrate that appraisers have a ubiquitous need to reduce cognitive effort when the search cost for information is high, even to the determent of performance quality. The authors find appraisers do not increase the number of sales examined when operating in unfamiliar markets relative to work performed in familiar markets. The authors contend that appraisers should increase sales search in unfamiliar markets requiring greater time-on-task, however instead of searching for additional information, appraisers tend to rely on frugal heuristics even though these heuristics typically ignore a substantial amount of available information. As a result, appraisers tended to rely on only a small number of informational cues.

Although, real estate is one of the last sectors of the economy to adapt data standardization and online informational services, technology has already transformed the way real estate information is retrieved, analyzed, transmitted, reported, and stored (Linne and Cirincione, 2008). Friedman (2005), describes technology driven change, and discusses how the world is being "flattened" by the move towards technology and standards. Linne and Cirincione (2008) argue that these two drivers, e.g., open data standardization and technological innovation, are reshaping the real estate industry, and by extension, the valuation domain. They conclude

that process and data standardization efforts will not only drive significant efficiencies into the market, they will reshape the nature of real estate analytics.

This realization for change is not a recent phenomenon. In the decision making literature several authors (Davis 1984; Huber 1984; Huber 1990 and Isenberg, 1984) have argued that the use of information technology will help managers recognize and overcome human deficiencies in decision making. Indeed, Simon (1987) stated "Over the past 40 years, the technique of decision making has been greatly advanced by the development of a wide range of tools in particular, the tools of operations research and management science, and the technology of expert systems." In the real estate domain, Gau, Lai, and Wang (1992) commented on the various automatic or semi-automatic approaches needed to make comparables selection more reliable and efficient in the appraisal domain. While Gallimore (1994) suggested that unless or until these automatic or semi-automatic approaches are adopted, the appraisal process will be greatly influenced by the characteristics of human decision making. Further, Gallimore comments that the emergence of information technology systems may lead to a greater reliance on simultaneous data review and processing, the implications of these developments should be studied.

Havard (2001) finds the form in which information is presented can successfully ameliorate a form of bias identified as transaction price anchoring bias, and suggest further research should be conducted on strategies to counter bias in the real estate domain. With decision support tools capable of filtering and searching through large data sets and with analytic capabilities available to commercial appraisers for the first time, it is becoming increasingly clear that the commercial real estate domain is transitioning from a highly fragmented and

informationally inefficient industry to one in which standardized, comprehensive and reliable data is now available to practitioners and academics.

The successful application of debiasing strategies would potentially have substantial practical implications due to the volume and diversity of appraisal users. Financial institutions represent a large number of appraisal end users as they are required to obtain an objective and accurate market valuation of the property, so that they can manage portfolio risk and reduce the loss in the event of a loan default. Figure 1 presents descriptive statistics on outstanding loan balances derived from the Federal Reserve Board of Governors. As of April 2010, outstanding real estate loans (i.e. commercial and residential) at commercial banks in the U.S. were approximately $3.715 trillion dollars with commercial loans representing 43% or $1.598 trillion[4]. In the first quarter of 2010, federally insured U.S.-chartered commercial banks in the US experienced a charge-off rate of 2.12% and a delinquency rate of 8.6%.[5] Figures 2 and 3 presents seasonally adjusted descriptive statistics on delinquency and charge-off rates on loans at commercial banks.

Real estate developers and investors also represent a substantial number of appraisal end users as they are interested in an accurate and objective valuation. The outcome of the appraisal could impact the decision on whether the expected return from a proposed development project is sufficient to offset the cost and risks. Figure 4 presents seasonally adjusted descriptive

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[4] Federal Reserve System (http://www.federalreserve.gov/econresdata/releases/statisticsdata.htm)

[5] Source: Federal Financial Institutions Examination Council (FFIEC) Consolidated Reports of Condition and Income (1985-2000: FFIEC 031 through 034; 2001-: FFIEC 031 & 041). Charge-offs, which are the value of loans removed from the books and charged against loss reserves, are measured net of recoveries as a percentage of average loans and annualized. Delinquent loans are those past due thirty days or more and still accruing interest as well as those in nonaccrual status. They are measured as a percentage of end-of-period loans.

statistics on the value of put-in-place private real estate in the US. The adjusted average value of new private construction in the US from January 2000 to April 2010 is approximately $731 billion dollars per annum. Additionally real estate investors prefer to know a reasonable market value of their properties, especially prior to acquisition and disposition decisions. Thus, attaining an independent and objective commercial property valuation is crucial to developers, financial institutions, and investors.

In recent years, the residential lending and appraisal industries have been the focus of regulations aimed at enhancing the independence and accuracy of the appraisal process. Two notable changes include the Home Valuation Code of Conduct (HVCC) and revisions to Regulation Z. The HVCC is the result of a joint agreement made in March 2008 and revised in May 2009 between Freddie Mac, the Federal Housing Finance Agency (FHFA), and the New York State Attorney General to enhance the independence and accuracy of the appraisal process.[6] HVCC requires complete independence within a lender's organization between the appraisal process and loan production and limits communication with the appraiser, and strictly prohibits lenders and third parties from influencing or attempting to influence the development, result, or review of an appraisal report. Fannie Mae and Freddie Mac will no longer purchase mortgages from lenders that do not adopt HVCC with respect to single-family mortgages. In 2009 the Board of Governors of the Federal Reserve System adopted an additional rule strengthening safeguards of Regulation Z.[7] The revised Regulation Z addresses lender conduct and explicitly forbids any coercion of appraisers by lenders.

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[6] Freddie Mac Home Valuation Code of Conduct Information
[7] Federal Reserve System (http://www.federalreserve.gov/bankinforeg/reglisting.htm#Z)

The recently adopted Home Valuation Code of Conduct (HVCC) as well as Regulation Z have profoundly changed the residential banking and appraisal industries, but have rendered the commercial real estate domain unaffected. These regulations also are primarily, but not entirely, focused on client influence as a potential source of appraisal bias. This is a needed step in the appraisal industry, but other potential sources of bias such as appraiser reliance on previous appraisal value estimates is not explicitly addressed in the current regulations. A reexamination of the influence derived from an anonymous expert's previous value opinion on commercial valuations will build support for existing theories or encourage the development of new theories concerning commercial valuer behavior. This study will provide insight into the impact of an anonymous expert's previous value opinion on the appraisal process, and the effectiveness of debiasing techniques in the commercial real estate domain.

To operationalize the research hypotheses a two-factor, randomized experiment was conducted. The first factor of interest is an anonymous expert's previous value opinion. Treatment for this factor is received at three-levels: low previous valuation, high previous valuation, and no previous value opinion. The second factor is the decision support tool in which half of the participants were given access. Commercial appraisers (n=60) were randomly solicited from the Atlanta, GA. area to participate as subjects. The statistical test conducted to test the stated hypotheses consists of the non-parametric Mann-Whitney U Test and the Kolmogorov-Smirnov (K-S) Test, the parametric procedures employed are Analysis of Variance (ANOVA), Student's t-test, and F-Test of variance.

1.3 Outline of the Dissertation

This chapter presents the general background, theoretical foundation and importance of the study. Chapter Two begins with an overview of the relevant literature from cognitive psychology concerning human information problem solving and heuristic behavior. Next, literature covering decision making debiasing strategies is discussed. The research methodology, research hypothesis, data collection and operationilization, and validity issues are covered in Chapter Three. Chapter Four presents the results of the study. Chapter Five will conclude the study with a summary of findings and implications for future research.

Chapter Two

Literature Review

This chapter will elaborate on the theoretical concepts and prior research from the psychology and real estate disciplines concerning the influences of heuristics on problem solving, providing a foundation for this study. The literature review is disaggregated into the following sections: human information processing related to problem solving behavior, heuristic behavior, feedback, and the debiasing role of information technology and decision support aids in decision making.

2.1 Human information processing related to problem solving behavior

The theoretical foundation commonly used in behavioral research in human problem solving is derived from Simon (1957, and 1978 and Newell and Simon (1972). Simon (1957) contends that decisions are made within a subset of all possible solutions based on the "bounded rationality" of individuals. In contrast to models of unbounded rationality where all information is readily available, bounded rationality is the concept that the rational capacity of people is limited by the search cost of information, cognitive limitations, and time constraints. Thus, bounded rationality revises the assumption of unbounded rationality to account for the fact that perfectly rational decisions are rarely feasible in reality due to the limited computational resources available. Simon recognizes the cost associated with gathering and processing information as a constraint on the classical models of rationality.

Newell and Simon (1972) and Simon (1978) broaden and refine Simon's earlier work by emphasizing cognitive limitations, and developing a general theory of human problem solving. They contend that human behavior is a function of the interaction between an information-

processing system, the problem solver, and task environment. The human information processing system is comprised of short-term and long-term memory, and is considered a serial system capable of processing only one order at a time. The problem solver is the person performing the task. The task environment is the task as described by the experimenter (the problem as it is presented); the problem space, or schema, is the way a particular problem solver defines the task. In responding to a task, the problem solver interprets the task environment into a problem space (one's unique way of viewing the task environment) where problem solving occurs. The interaction between these three components establishes the foundation for problem-solving behavior.

Problem-solving efforts of the human information processing system are guided by several characteristics. Humans process information serially, only one task at a time, rather than in a parallel (more than one task at a time) fashion. The information processing is comprised of short-term and long-term memory. Long-term memory has unlimited storage capacity, consisting of symbols or "chunks" of stored information. However, indexing and recall can be time-demanding and inefficient. Short-term memory has limited capacity, capable of only storing between four and seven "chunks" or pieces of information, and acts as the task environment filter for the information processing system. The short-term memory is comprised of a language interpreter, which functions to understand the problem, and problem space, where problem solving occurs. The problem space is constrained by the informational storage capacity of short-term memory.

To initiate problem-solving, the problem solver must represent the task environment in the problem space contained in short-term memory. The ease of solving a particular problem is

conditioned on the ability of the problem solver to effectively interpret the task environment in the problem space. The problem space consists of a set of nodes representing a possible state of knowledge that the problem solver may attain and is able to retrieve swiftly (fraction of a second). The capacity limitations of short term memory make it difficult for problem solvers to effectively "backtrack" to previous nodes, instead they almost completely focus on proceeding from the current situation.   Simon (1978) notes that when sufficient external memory (e.g. information and decision support systems) is provided problem solvers may be more willing to "backtrack" from an unpromising situation to a more promising one reached earlier.

2.2 Heuristic behavior

The general mechanics of human information processing is robust across subject domain experts and novices solving both well-structured and ill-structured problems (Simon 1978). However, there is considerable evidence that experts, as compared to novices invoke different, and in some cases superior, information processing strategies (Simon and Simon, 1978; Larkin, McDermott, Simon, and Simon, 1980a, 1980b; Selnes and Troye, 1989; Simon and Schaeffer, 1992; Gobet and Simon, 2000).   Experts and novices may differ in their initial state of knowledge, amount and type of new information considered, and in how they navigate the problem space. Experts tend devote more effort to identify and define the problem, and examine problems more deeply than novices. Evans (1989) suggests that experience and training will foster improved task recognition and enhanced development of a particular problem space. Therefore, in short-term memory experts are capable of forming richer data symbols expanding the processing capabilities of the problem space. Additionally, an expert is better equipped to work in an ill structured task environment, through the development of problem solving short-cuts known as heuristics.   Although the use of heuristics (i.e. cognitive short-cuts) can be an

efficient way of processing information, they may lead to systematic errors called judgmental bias.

Heuristics are a learned behavior as a result of environmental feedback, experience, training and active searches (see Evans, 1989; Baron 1985; Svenson, 1979). It is through these experiences that individuals develop heuristics that streamline the solution process fostering an efficient analysis of data. There are many reasons for using simplified heuristics in problem solving, most notably: individuals simplify due to the cost of time and effort which may act as constraints on practical processing given the task environment, and because the use of heuristics has worked satisfactorily in the past and they are easily recalled in memory.

In their seminal work, Tversky and Kahneman (1974) began a research program examining heuristics and biases. They identify several types of cognitive heuristics employed in problem solving, e.g., representativeness, availability and anchoring and adjustment. These simplified problem solving methods are intended to cope with humans' limited amount of storage and processing capacity in short-term memory by selective and simple use of information to solve decision problems. Much of the more recent research in heuristics and associated biases consolidates previous findings, delineates under which circumstances specific biases are likely to appear (Koehler, 1996) and increases the number of newly identified heuristics and biases. Baron (2002) lists at least 25 biases and Hogarth (1980) lists at least 29 heuristics. However, these have not been as widely investigated as the original three heuristics as defined by Tversky and Kahneman.

The use of heuristics may provide efficient procedures for solving complex problems given the limited information processing capabilities of human problem solvers. However, through experience (i.e. learned behavior) heuristic procedures can develop into routinized

subconscious responses to the task environment.   This can be problematic when the modifying effects of experience on normative training trigger a routine response that differs from the normative process (Svenson, 1979; Evans, 1989). The use of heuristics in some situations can lead to systematic decision errors resulting in judgmental bias. Shanteau (1992) postulates that when individuals are asked to solve ill-structured tasks characterized by poor feedback and uncertainty, similar to the real estate domain, heuristic use is likely to result in potentially biased and sub-optimal solutions.   This occurs when individual's task perceptions differ from a normative standard and heuristics developed for efficient decisions are misguided (Baron, 1985; Evans, 1989).   Consequently, systematic human error in judgment is often not motivated by irrationality, but the result of a constrained information processor relying on simplified procedures which are misapplied (Tversky and Kahneman, 1974). Thus, oftentimes heuristic use manifests in departures from the appraisal normative process potentially resulting in biased judgments.

The appraisal normative model[8] consists of an eight-step prescribed valuation process set forth by the Appraisal Institute[9] which must be followed when conducting a valuation task. The normative model is regulated by The Appraisal Standards Board (ASB), which develops and

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[8] The appraisal normative model was established by the Real Estate Appraisal Reform Amendment or Title XI of Public Law 101-73: Financial Institutions Reform, Recovery and Enforcement Act (FIRREA) of 1989. This Act established the Appraisal Subcommittee (ASC) to monitor and oversee state and federal appraisal certification and licensing of real estate appraisers engaged in federally related transactions. The ASC reviews the operations and provides input to the Appraisal Foundation, a private, not-for-profit corporation which promulgates the Uniform Standards of Professional Appraisal Practice, and the minimum educational and experience standards for appraisal licensure.

[9] The Appraisal Institute is the largest member organization in the appraisal profession and the world leader in appraisal education procedures (The Appraisal of Real Estate, 2001).

interprets the Uniform Standards of Professional Appraisal Practice (USPAP) providing a minimum set of quality control standards for the development of an appraisal and the reporting of its results.   USPAP requires that appraisers be familiar with and properly employ prescribed appraisal methodology, i.e., the normative valuation model. The Scope of Work rule was added to USPAP in July 2006, requiring the appraiser to discuss a priori the amount and type of information to be researched, and the analysis to be applied in order to solve the appraisal problem. Formulating the scope of work necessary prior to beginning the assignment in accord with the normative model should reduce deviation from the prescribed model.   Although previous research suggests anonymous expert value opinions play a role in the calibration of judgments, the appraisal normative model does not sanction the use of value opinions as part of the appraisal process. Thus, appraisers operating under the normative model should not allow anonymous expert value opinions to influence judgment outcome when performing an appraisal task.

The use of information processing heuristics and resulting biases are well documented in the extant real estate literature. In one of the first studies of heuristics and bias in the real estate domain, Northcraft and Neale (1987) examine the anchoring and adjustment heuristic in the context of single-family residential property. Participants consisting of practicing real estate agents (experts) and undergraduate students (novices) were provided a 10-page packet containing all the information local real estate agents might use in their evaluation or a house. The only deviation between information packets was the listing price, which served as the anchor.   The anchor was presented in four levels normally distributed around the actual appraised value, providing four experimental conditions. After receiving the information packet, subjects toured the house and surrounding neighborhood and then provided estimates of the

appraised value of the property, appropriate listing price, reasonable price to pay for the house, and minimum selling price. The impact of the listing price anchor at all levels, across all these estimates was significant for both experts and novices. This study provided strong evidence that the results of previous research on heuristic and biases in laboratory settings were not merely "parlor tricks" but robust to "real world" settings. However, the use of real estate sales agents as expert valuers limits their results. The typical real agent may be considered experts in marketing and are likely familiar with pricing techniques, but lack appraisal experience and receive no formal training in the appraisal process. Thus, it would be in error to infer that real estate sales agents are "expert" real estate valuers.

Diaz (1990a) and (1990b) began a research program investigating information-processing techniques of real estate appraisers. Diaz (1990a) finds that residential real estate appraisers depart from the normative appraisal model in both familiar and unfamiliar task environments (geographical settings). He alludes to subsequent research on the subject of appraiser behavior, by observing that non-normative appraisal behavior may lead to suboptimal valuation judgments placing "objective" valuations at risk of systematic biases. Diaz (1990b) finds that the information-processing technique that expert real estate appraiser's exhibit when selecting residential comparable sales differs from novices (students). Experts relied on a more cognitively efficient selection strategy focusing on key attributes and limiting the number of comparables examined. Conversely, novices spent more time on the task and examined more data. Diaz suggests that expert appraisers develop cognitive shortcuts or heuristics, which may be efficient but may also lead to bias. Over time, the use of schema or heuristics may become production rules that guide the sales selection process.

In the first large-scale real estate behavioral study conducted in the UK, Gallimore (1994) examines three information processing heuristics which may lead to bias in real estate valuation judgments. The heuristics considered are anchoring, recency and dilution. Anchoring, as formulated by Tversky and Kahneman (1974) is the contention that when individuals are asked to arrive at an estimate, they often do so by adjusting from an initial reference point as evidence is assimilated. Recency and dilution, attributed to Einhorn and Hogarth (1985), are presentational effects suggesting that the assimilation of new information is influenced by the order and mode in which it is presented. The recency effect contends that when data are analyzed sequentially, greater emphasis is placed on the most recent data analyzed. Dilution is the notion that the mode in which data are presented (i.e. sequentially or simultaneously) may influence the valuation adjustment process. Those inclined to accept new evidence (either supportive of, or challenging to, existing views) will adjust to it less when consistent evidence is presented simultaneously with challenging evidence, therefore diluting the impact of new information. Gallimore finds strong support for the anchoring and recency effect among appraisers, but no evidence is found for the dilution effect. The response to the recency effect appears to be asymmetric with only supporting (positive) evidence producing the predicted effect.

Driven by Gallimore's (1994) findings suggesting that appraisers adjust less to negative evidence than to evidence which supports an existing view, Gallimore (1996) seeks to explicitly test for confirmation bias. Confirmation bias is the inclination to seek out evidence that supports prior opinions. In the valuation context, this is when appraisers form an opinion of value early in the appraisal process and then seek evidence to support the initial value, rather than objectively

search for the most salient evidence. Gallimore concludes that the presence of confirmation bias remains unproven.

Wolverton (1996) and Gallimore and Wolverton (1997) empirically test the contentions of the Diaz (1990a and 1990b) studies and build upon the findings of Gallimore's earlier work. The authors examine the impact of pending sales price and listing price knowledge on comparable sales selection and valuation judgments by expert residential appraisers in the U.S. and England. In comparison to the English valuers, the American appraisers tended to exhibit less bias (although statistically significant) in valuation judgments, but a stronger bias in comparable sale selection when aware of pending sale price. The authors contend, that in contrast to normative appraisal training, the routinization of non-normative heuristics over-emphasize the importance of the pending transaction price of the subject property, and therefore lead to bias in the comparable sales selection process and valuation judgment.

Although, both UK valuers and US appraisers are significantly influenced by the pending transaction price, the differences in magnitude are attributed to their unique task environments. UK valuers at the time of the study had less reporting requirements, operate in environments with poor data quality and are generally accustomed to making large adjustments to comparables to arrive at the subject's value. Residential appraisers have access to a comprehensive residential data set (Multiple Listing Service) and must support their valuation judgments through a reporting process. Standardized residential appraisal forms are utilized to provide relevant property and regional information to the client, these forms include a section in which comparable properties are adjusted and the respective justification of such adjustments is explained.

The valuation behavioral research in real estate was expanded by Diaz (see Diaz 1997, Diaz and Hansz 1997 and Diaz and Wolverton 1998) in a successful attempt to explain the appraisal smoothing phenomenon documented in earlier research. Ibbotson and Siegel (1984) were the first to recognize that a differential existed between real estate return series constructed using appraised values as substitutes for actual transaction values. The authors find valuation-based returns contain less variability than one would expect from transaction based returns. Cole (1988) empirically tested this contention by comparing valuation-based series to transaction-based indices and confirmed valuation-based series exhibit reduced variability. Cole identifies several factors which may contribute to appraisal smoothing: insufficient adjustment from past valuation judgments, annual rather than quarterly appraisals, and client influence. Geltner (1989a and 1989b) defines appraisal smoothing and devises a smoothing correction technique for valuation-based return data. Geltner (1989b) suggest appraisal smoothing is a function of relying to heavily on past "acceptable" valuations, presumably the result of a lack in confidence triggered by uncertainty in newly available information. Quan and Quigly (1991) echo a similar sentiment when describing why appraisal smoothing is rational appraiser behavior. They authors use Bayesian statistical theory to show how appraisers operating in an environment characterized by limited and noisy information will only partially update their valuation estimates based on current market conditions. McAllister, Baum, Crosby, Gallimore and Gray (2003) find that the IPD commercial property index exhibits characteristics consistent with appraiser smoothing behavior; however the authors find a seasonal effect with greater search cost and information being applied to annual and quarterly appraisals than monthly. This increase in information results in a reduction in smoothing in quarterly and annual appraisals.

A series of separate studies shed additional light on the behavior of individual appraisers by applying a behavioral approach grounded in psychological theory. Diaz (1997) finds expert US appraisers operating in familiar geographic areas do not anchor to the previous valuation judgments of anonymous experts when conducting a current valuation. Conversely, Diaz and Hansz (1997) find expert appraisers operating in an unfamiliar geographic setting were influenced by the previous valuation judgments of anonymous experts. The authors suggest that market uncertainty may induce the use of an unsanctioned reference point (anchoring heuristic) that would not otherwise impact judgments. Diaz and Wolverton (1998) find expert appraisers operating in unfamiliar geographic territory will make insufficient adjustments when reappraising (updating) appraisal assignments. Clayton, Geltner and Hamilton (2001) also find evidence of appraisal smoothing when examining a large data-set of individual property appraisal reports performed over the 1986 – 1996 time period. While business pressure or agency issues may contribute to smoothing, Diaz and Wolverton (1998) find evidence of appraisal smoothing in the absence of client pressure. The authors attribute this form of appraisal smoothing to problem solving behavior namely the anchoring and adjustment heuristic. Hansz (2004) finds evidence that commercial appraisers induced by prior transaction price knowledge employed a partial adjustment strategy, as proposed by Quan and Quigley (1989, 1991), when asked to perform a current valuation on the subject property. In contrast to expert commercial appraisers, nonappraisers did not employ a partial updating strategy; however their estimates were "noisier".

Although, previous research documents that expert appraisers operating in areas of geographic unfamiliarity may be influenced by the value estimates of anonymous experts, research into the impact of other potential reference points on appraisal judgment has been

absent. Diaz and Hansz (2001) fill this gap by examining the impact of additional potential reference points. The authors examine the impact on valuation judgment resulting from knowledge of an uncompleted contract price of a comparable property, the uncompleted contract price on the subject property, and the value opinion of anonymous experts. They hypothesize the hierarchy of impact will be consistent with the degree to which each reference point adheres to the US normative appraisal model and to the frequency each reference point is encountered in practice. Contract prices of both comparable and subject property enjoy implicit support in the appraisal process; however value opinions of experts are not sanctioned by the normative appraisal process. The authors find all three reference points impact valuation judgment, and as expected the implicitly sanctioned reference points (e.g. unclosed contract price of comparable and subject property) exhibit a greater influence.

In a related study, Havard (2001) examines whether the mode of data presentation can counter bias arising from the tendency of appraisers to anchor to the transaction price of the subject. They contend that information presented in a tabulated summary table will provide a more "vivid" presentation of comparable transaction information and have a mitigating effect on bias. Indeed, the author finds that in the commercial real estate domain tabulated information does have a damping effect on bias resulting from the use of the anchoring and adjustment heuristic. The author cautions the reader in that the findings were based on student participants and suggest that ultimately this research should be done with practicing appraisers. Furthermore, Harvard calls for additional research focused on alternative debiasing strategies.

Hansz (2003) examines the influence of tax assessed values on the formation of market value estimates by both commercial appraisers and nonappraisers and finds that knowledge of assessed values did influence the market valuation of nonappraisers, but value judgments of

appraisers were not affected. Tax assessed values have been found to be poorly calibrated (see Kowalski and Colwell, 1986; and Janssen and Soderberg, 1999), experienced commercial appraisers have likely formulated the same conclusion. Thus, these results indicate that commercial appraisers need some form of content validity prior to using a reference point as an anchor.

In addition to the heuristics previously mentioned appraisers have also been susceptible to the biasing influence of market and client feedback. These types of studies are generally theoretically grounded in the Brunswik (1952 and 1956) lens model of perceptual. This theory provides a foundation for the examination of the relationship between appraiser and client, in which client feedback is incorporated into the learning process. Brunswik contends that the perceptual system includes the task (ideal) system and the cognitive system (individual perception of task system). The task system represents the environment, and the cognitive system is the individual's perception of the environment. That is, individuals cannot view the event being judged directly, but instead must view the event through a filter of "cues" (pieces of information). Individuals form their perception of the environment through the use and weighting of "cues" which shape their understanding of the environment. Feedback provides the information needed to compare the cognitive system to the task system. Based on this feedback, the individual can calibrate the cognitive system so the attributed cue weights will more closely resemble the optimal weights (Doherty and Balzer, 1988).

The conceptual framework of the lens model can easily be applied to the real estate appraisal task. The criterion to be judged is the market value of a subject property as of the date of value (task system). The judge is the appraiser (cognitive system), who must render a judgment through the optimal weighting of "cues" (pieces of information). Cues include

normatively prescribed items of information such as: market area data, subject property data, and comparable property data. Since the criterion to be judged (market value) is an unobserved hypothetical value, feedback from clients, colleagues and the market provide information on the relation between the criterion and the appraiser's judgment of market value. Thus, through feedback, the appraiser can calibrate the cognitive system to more closely relate with the task system (Doherty and Balzer, 1988). Indeed, Klein (1998) identifies accurate and timely feedback as an important source of learning for experts. However, problems may arise if the feedback contains an element of systematic bias, these problems may manifest in departures from the appraisal normative process potentially resulting in bias judgments.

Hogarth (1980) contends that feedback is central to the learning process of experts, but cautions that feedback may contribute to non-normative practices. In order for feedback to be effective it must reveal whether past judgment was accurate, this is difficult in the appraisal domain as the "true" market value is unobservable. In this setting, feedback assessing the correctness of the valuation judgment may only come in the form of accepted convention (e.g. proximity to contract price or value required for financing) rather than the accuracy of the valuation judgment. Indeed, feedback which contains this form of systematic bias may over time override formal appraisal training, resulting in an appraiser departing from the normative appraisal process in favor of a judgment process which conforms to convention (Svartdal, 1995).

Previous valuation research has shown that the type of feedback from clients can vary substantially, and often client feedback is directed at encouraging appraisers to deviate from the prescribed valuation objective. Smolen and Hambleton (1997) surveyed 292 US residential and commercial appraisers and find that appraisers are subject to a substantial amount of client feedback. In fact, 79% of appraisers surveyed reported that clients sometimes behave in a

manner which pressures appraisers to alter value judgments, mortgage bankers were cited as the most frequent source of client pressure. Levy and Schuck (1999) conducted in-depth interviews with five experienced New Zealand commercial appraisers to examine the pervasiveness of client influences on the valuation process. Their study provides evidence suggesting client influences is an important source of appraisal bias. The authors find clients are more likely to adjust their initial value judgments at the client's request when facing a paucity of market data or uncertainty in the available data. They rationalize their decision to appease the client citing the possibility of appraisal error caused by a lack of reliable data, and therefore contend a range of defensible values exist. The authors conclude that access to in-depth transactional information may give appraisers more confidence in their initial value estimates reducing the potential for client influence.

Wolverton and Gallimore (1999a) and Gallimore and Wolverton (2000) survey appraisers in both the US and the UK and identify three possible forms of client feedback: environmental perception feedback, coercive feedback, and positive reinforcement. They find that environmental perception (i.e. non-threatening feedback) is more common than more overt coercive feedback. Furthermore, the authors find that in both the US and UK appraisers perceive that the clients view the appraiser's role in the lending process as price validators; however, generally appraisers do not view their own role in this manner. More recently, similar results of client influence on the appraisal process have been found in Nigeria (see Amidu and Aluko, 2007; and Amidu, Aluko, and Hansz, 2008).

In addition to the studies providing evidence that clients often present feedback to appraisers in an attempt to alter the initial value judgment, there are also a few studies examining

the willingness of appraisers to alter valuation judgments based on client or market feedback. Kinnard, Lenk, and Worzala (1998) surveyed US commercial appraisers to examine the impact of client valuation feedback on the appraisal process. The authors used hypothetical case scenarios placing appraisers in a "situation" where the lender-client is requesting an increase in the valuation estimate; the authors found that 41% of the commercial appraisers sampled revised their valuation judgments.

Hansz and Diaz (2001) examine market feedback in the absence of client influence. They conduct a one-factor repeated-measures experiment examining market feedback (transaction price information after the valuation has occurred) and find that transaction price feedback does indeed influence future, unrelated valuation judgments. The observed feedback effect is not symmetrical, commercial appraisers receiving feedback that their valuation estimates were "too low" based on the subsequent transaction price tended to adjust their valuation judgments significantly upward on the following unrelated value task. Subjects receiving the "too high" feedback did not significantly adjust future valuation judgments. The authors contend that this asymmetric response is consistent with notion of anchoring as a routinized response to agent-client hazards and may be time variant based on market conditions.

Diaz and Hansz (2010) introduce a taxonomic approach to field research in examining the impact of client influence on the residential valuation process. A taxonomic approach offers an alternative methodology to the more traditional real estate research designs by allowing the use of small samples when the population characteristics are known or can be estimated. In this study, the population of expected values for three unique residential houses was defined using hedonic regression analysis and judgments from actual appraisals were tested against this normal

distribution of values. The authors find statistical evidence that agent-client concerns influenced the valuations of real-world independent residential appraisers hired to provide an objective value estimate. Because of the many differences between commercial and residential real estate, Diaz (1990) cautions that "…confident generalizations cannot be made between residential and commercial appraisers".

In the commercial valuation context, previous agent-client research as documented through the use of surveys and interview techniques, find clients attempt to impact valuation judgments primarily through environmental perception feedback. In separate studies both Diaz (2010) and (Kinnard, Lenk, and Worzala, 1997) find appraisers are influenced by client feedback, resulting in biased valuation judgments.

2.3 The Debiasing Role of Decision Support Systems in Decision Making

Decision research has used rational theories from economics and statistics to argue that descriptive behavior often is systematically different than prescribed normative behavior. Descriptive behavior generally falls short of the ideal behavior resulting in systematic biases which vary across disciplines. As mentioned earlier, several real estate studies document departures from the appraisal normative process revealing a normative-descriptive gap. One of the contributing factors for this nonprescribed behavior is that commercial appraisers tend to lack confidence in value judgments due to market uncertainty. Diaz and Hansz (1997) find appraisers tend to anchor to unsanctioned reference points when operating in a geographically unfamiliar environment as a result of an increase in market uncertainty, which results in the appraiser having lower confidence in the valuation estimate. Levy and Schuck (1999) suggest that a lack of reliable data increases the probability of appraisal error and increases appraiser susceptibility to client influence. In fact, client influence in the form of outcome feedback may lead to under

confidence in subsequent judgments (Arkes, Lai, and Blumer, 1987). Levy and Schuck (1999) contend commercial appraisers would be more confident in their value estimates and less susceptible to influence if appraisers had access to in-depth transactional information. Additionally, Quan and Quigly (1991) and Geltner (1989b) suggest that appraisal smoothing is an artifact of appraisers placing to great of weight on the initial value when updating an appraisal due to a uncertainty and lack of confidence in their ability to accurately determine current market value.

Recently, research programs have been developed to examine how the normative-descriptive gap might be closed. This type of research is labeled as "debiasing", because it seeks techniques to help the decision making process approach normative standards. There are two primary debiasing strategies: one focusing on cognitive strategies (Meliorists) and another focusing on techniques external to the decision maker (Technologists). Meliorists believe decision maker's cognitive strategies can be modified to be in-line with the prescribed normative process through formal education/training and experience (Nisbett, 1993 and Stanovich, 1999). However, the extent to which purely cognitive strategies can improve decision making is a source of debate. Apologists suggest that attempts focused on enhancing cognitive strategies will fall short of achieving prescribed normative standards because of cognitive limitations (Gigerenzer, 2004).

The Technologist approach to debiasing contends that through the use of external tools, decision makers can be debiased and their decision process can approach normative standards. This approach uses decision support aids (tools) and informational displays to improve information processing. Gigerenzer and Selten (2001) point out that an individual's search for

information can be performed in two general ways: internally through memory or externally through the use of information systems. Technolgists argue that focusing on only internal cognitive strategies for debiasing is not sufficient; instead they believe decision makers should make use of available and in some cases superior external decision support tools (Larrick, 2004). Edwards and von Winterfeldt (1986) argue that when external decision support tools are available to experts, they will be adopted to assist in the decision making process. They surmise that an "unaided expert" may be an oxymoron.

The use of technology in the form of a decision support aid has the ability to reduce search and processing cost (Payne, Bettman, and Schkade, 1999). Reduced information search and processing cost may reduce reliance on cognitive simplification mechanisms i.e., heuristics, that minimize information processing (Conlisk 1996). Technology can help ensure that attention is spread more efficiently and evenly across relevant attributes and across a variety of alternative options.

It is well documented that individual's decision solving strategies are adaptive and therefore a variety of mechanisms can impact strategy selection (Einhorn and Hogarth, 1981 and Johnson and Payne, 1985). Payne (1982) suggests that individuals focus on trade-offs between effort and quality in decision making, where decision quality is generally operationalized as the deviation of a task solution from the expected solution based on the normative strategy. Subsequent empirical and simulation work has generally supported this cost-benefit decision framework (see for example, Bettman, Johnson and Payne, 1990; Creyer, Bettman and Payne, 1990; Stone and Schkade, 1991; Bettman and Johnson, 1993). This cost-benefit framework suggests that decision makers have two conflicting objectives, and generally behave in a way

which maximizes the tradeoff between high accuracy (quality) and low effort. Of the two objectives, decision makers generally weight effort minimization more heavily than high accuracy (Johnson, Payne, and Bettman, 1998; and Payne, Bettman and Johnson 1988 & 1990; Kleinmuntz and Schkade, 1993). The likely reason that effort is the key determinant of strategy selection is that feedback from effort is immediate and reliable, however feedback from accuracy can be less timely and ambiguous (Einhorn and Hogarth, 1978, 1981; Kleinmuntz and Schkade, 1993).

In a series of experiments Todd and Benbasat (1991, 1992, 1994a, 1994b, 1999, and 2000) suggest that in general individuals tend to adapt their decision strategy based on the type of decision support aids available. The authors find that decision aids can enhance the decision making process resulting in more normative based strategies when they reduce search cost or effort expended by the decision maker. However, if the use of a decision aid is expected to result in greater effort than the unaided decision, given the two strategies decision makers may choose the strategy which is expected to require less effort. Thus, Todd and Benbasat (2000) contends that " In order to induce the use of a superior (normative) decision strategy and, as a consequence improve decision quality, a decision aid must make that superior strategy at least as easy to employ as any simpler but less accurate heuristic. Otherwise, the decision aid may only improve decision making efficiency. This will occur because decision makers use decision aids in such a way as to minimize their overall level of effort expenditure." The authors find, consistent with their contentions, that decision support aids can induce the use of strategies that are normatively oriented if they do not require additional cognitive effort.   Additionally, Edwards and Fasolo (2001) find that the use of technology as a decision support aid can substantially reduce the cost of effort in the "effort-accuracy" tradeoff. Edwards and Fasolo (2001) contend that judgmental

decision making can be summarized in a comprehensive 19-task model prescribed to insure an optimal combination of values and probability. Eight of the tasks can be enhanced through the use of external technology and decision aids. The authors conclude by comparing the usefulness of decision aiding tools in the 21st century to the impact spreadsheets had in the 20st century.

Decision support aids (e.g. CoStar in the commercial real estate domain) allow the user flexibility in the form of data presentation. A growing stream of literature suggests that one of the more successful means of enhancing and debiasing the decision-making process is through the way in which information is displayed (see Kleinmuntz and Schkade, 1993, for a review of the literature). Decision support aids often times allow the user to control the way in which data are presented, including the capacity to sort and present data in matrix or tabulated format. Slovic (1972) finds that to avoid expending additional cognitive effort, individuals generally accept data in the form in which it is presented, and are unwilling to manually transform it. The use of decision support aids can mitigate the need for manually reformulating the data, thus making it more likely that the decision maker will utilize tabulated informational displays. The central theme emerging from this literature is that informational displays impact the decision-making process by reducing the cognitive effort needed for carrying out decision process and that the simultaneous display of information can have a debiasing effect (Kleinmuntz, 1993).

In the real estate domain, Havard (2001) finds evidence of the debiasing effect simultaneous data presentation has on the decision process. He finds that information presented in a tabulated format removed a transaction price induced anchoring bias in student subjects. Similarly, Schkade and Kleinmuntz (1994) in a study asking sixty MBA students to choose the best alternative among eight loan applications find that data presentation strongly influences

information acquisition and evaluation. They conclude that one of the most encouraging opportunities, enhanced through the use of decision support tools, for improving and debiasing decision making is the ability of the user to control information presentation assisting the decision maker in acquiring and processing relevant data.

Commercial real estate professionals now operate having efficient access to comprehensive market data and decision support tools that can analyze and aggregate data efficiently. It is evident that there are theoretical and practical ramifications that must be considered and tested empirically. Therefore an examination of how the use of decision aids may affect the commercial appraisal process is a timely research question with substantial practical implications. The current study builds on the body of knowledge by employing a two-factor, randomized, continuous valuation problem to statistically examine the debiasing potential of decision support tools utilized in the commercial valuation process in the presence of a non-sanctioned reference point (expert's anonymous value opinion).

Chapter Three

Data Generation and Methodology

In the previous chapter the theoretical concepts and prior research from the psychology and real estate disciplines concerning human information processing related to problem solving behavior, the influences of heuristics on problem solving, and the debiasing potential of decision support tools were discussed. In this chapter, the research hypotheses are formulated, and research design and methodology are discussed. This chapter will also address the use of CoStar as a decision support tool.

3.1 Test Hypotheses

Table 2 provides a summary of the abbreviations used to describe the research Hypotheses.

Table 2 Summary of Abbreviations

Abbreviation	Explanation
CS_C	CoStar Control group
CS_L	CoStar Low Anchor group
CS_H	CoStar High Anchor group
NCS_c	Non-CoStar Control group
NCS_L	Non-CoStar Low Anchor group
NCS_H	Non-CoStar High Anchor group

As a validity check to insure the similarity in appraised values between the CS_C and NCS_c and test for the presence of testing bias, the null of no testing bias should not be rejected, expressed as: Ho: $CS_C = NCS_c$.

The research hypotheses can formally be stated as follows:

Research Hypothesis 1(a,b,c,d): There will be no valuation differences detected between

subject groups when they utilize CoStar as a decision support

tool.

Test Hypotheses for Research Hypothesis 1:

   a. Ho_{1a}: $CS_C = CS_L = CS_H$ Ha_{1a}: $CS_C \neq CS_L \neq CS_H$

   b. Ho_{1b}: $CS_C = CS_L$ Ha_{1b}: $CS_C \neq CS_L$

   c. Ho_{1c}: $CS_C = CS_H$ Ha_{1c}: $CS_C \neq CS_H$

   d. Ho_{1d}: $CS_L = CS_H$ Ha_{1d}: $CS_L \neq CS_H$

   The research expectation in all cases is that the null of no difference between groups
across all procedures as discussed in Section 3.3 would not be rejected. This result would
provide some evidence that CoStar used as a decision support tool was effective at eliminating
the treatment induced bias found in earlier studies.

Research Hypothesis 2a: There will be valuation differences detected between subject groups

when they are not allowed to use CoStar as a decision support tool.

Ho_{2a}: $NCS_C = NCS_L = NCS_H$ Ha_{2a}: $NCS_C \neq NCS_L \neq NCS_H$

   Since the participants for these groups are not allowed access to the decision support tool
(CoStar), the research expectation is to reject the null hypothesis in favor of the alternate. That
is, the value estimates produced by the subject groups will significantly differ.

Research Hypothesis 2b: Compared to a Non-CoStar control group of appraisers receiving no

treatment, a Non-CoStar treatment group receiving a low anchor

value in the form of a value opinion of an anonymous expert will

yield lower valuations.

$Ho_{2b}: NCS_C \leq NCS_L$ $\qquad\qquad\qquad$ $Ha_{2b}: NCS_C > NCS_L$

Since the participants for these groups are not allowed access to the decision support tool (CoStar), the research expectation is to reject the null hypothesis in favor of the alternate. That is, the value estimates produced by the subjects receiving the low anchor treatment are expected to be significantly lower than the group not receiving the treatment.

Research Hypothesis 2c: Compared to a Non-CoStar control group of appraisers receiving no

treatment, a Non-CoStar treatment group receiving a high anchor

value in the form of a value opinion of an anonymous expert will

yield higher valuations.

$Ho_{2c}: NCS_C \geq NCS_H$ $\qquad\qquad\qquad$ $Ha_{2c}: NCS_C < NCS_H$

Since the participants for these groups are not allowed access to the decision support tool (CoStar), the research expectation is to reject the null hypothesis in favor of the alternate. That is, the value estimates produced by the subjects receiving the high anchor treatment are expected to be significantly higher than the group not receiving the treatment.

Research Hypothesis 2d: Compared to a Non-CoStar group of appraisers receiving a low

anchor value in the form of a value opinion of an anonymous expert, a

Non-CoStar group receiving a high anchor value in the form of a

value opinion of an anonymous expert will yield higher valuations.

$Ho_{2d}: NCS_L \geq NCS_H$ $\qquad\qquad\qquad$ $Ha_{2d}: NCS_L < NCSH$

Since the participants for these groups are not allowed access to the decision support tool (CoStar), the research expectation is to reject the null hypothesis in favor of the alternate. That is, the value estimates produced by the subjects receiving the low anchor treatment are expected to be significantly lower than the group receiving the high anchor treatment.

Research Hypothesis 3a: Compared to a Non-CoStar group of appraisers receiving a low anchor value in the form of a value opinion of an anonymous expert, a group of appraisers utilizing CoStar and also receiving the same low anchor value will yield higher valuations.

$Ho_{3a}: NCS_L \geq CS_L$ $\qquad\qquad\qquad$ $Ha_{3a}: NCS_L < CS_L$

In Research Hypothesis 3_a the NCS_L is compared directly with the CS_L group with the expectation that the values produced by the NCS_L group will be significantly lower than those produced by the CS_L group. The CS_L group has access to a decision support tool (CoStar) and I expect this to eliminate or subdue associated bias resulting from the administered treatment. Therefore, the research expectation is to reject the null hypothesis in favor of the alternate.

Research Hypothesis 3b: Compared to a Non-CoStar group of appraisers receiving a high anchor value in the form of a value opinion of an anonymous expert, a group of appraisers utilizing CoStar and also receiving the same high anchor value will yield lower valuations.

$Ho_{3b}: NCS_H \leq CS_H$ $\qquad\qquad\qquad$ $Ha_{3b}: NCS_H > CS_H$

In Research Hypothesis 3_b the NCS_H is compared directly with the CS_H group with the expectation that the values produced by the NCS_H group will be significantly higher than those

produced by the CS_H group. The CS_H group has access to a decision support tool (CoStar) and I expect this to eliminate or subdue associated bias resulting from the administered treatment. Therefore, the research expectation is to reject the null hypothesis in favor of the alternate.

Table 3 provides a summary of the research hypotheses, the research hypotheses are presented as the research expectation.

Table 3 Summary of Research Hypotheses, presented as research expectations

Hypotheses 1		Hypotheses 2		Hypotheses 3		Validity
$RH1_a$	$CS_C = CS_L = CS_H$	$RH2_a$	$NCS_C \neq NCS_L \neq NCS_H$	$RH3_a$	$CS_L > NCS_L$	$CS_c = NCS_c$
$RH1_b$	$CS_c = CS_L$	$RH2_b$	$NCS_c > NCS_L$	$RH3_b$	$CS_H < NCS_H$	
$RH1_c$	$CS_c = CS_H$	$RH2_c$	$NCS_c < NCS_H$			
$RH1_d$	$CS_L = CS_H$	$RH2_d$	$NCS_L < NCS_H$			

Notes: CS_C = CoStar Control group; CS_L = CoStar Low Anchor group; CS_H = CoStar High Anchor group; NCS_C = Non-CoStar Control group; NCS_L = Non-CoStar Low Anchor group; NCS_H = Non-CoStar High Anchor group.

3.2 Research Methodology

This research examines behavior in the form of valuation judgments of commercial real estate appraisers; as such, it falls within the behavioral real estate research paradigm. This lineage of research generally employs three research methods: process tracing, controlled experiments and field surveys. The present study employs the controlled experiment methodology.

The controlled experiment has been widely used in behavioral research (including in the real estate domain), and offers an advantage in the context of this study over competing methodologies. Generally, experimental designs exhibit the strongest internal validity of the

three designs. As such, it is effective at assessing cause-effect relationships (Trochim and Donnelly, 2007). In the simplest form (two-group, post-test only, randomized experiment), the experimental design allows for the testing of two equivalent groups, one of which receives the treatment (treatment/program group) and the other group (control group) does not.   In all other respects the two groups remain similar; this is achieved through random assignment of groups. Random assignment insures the two sample groups are equivalent within a known probabilistic confidence range, rendering any statistically significance differences in the outcome between sample groups the result of an administered treatment. Typically, the outcomes are tested using mean difference test such as t-test or one-way analysis of variance (ANOVA).

Although the controlled experiment has high fidelity with respect to internal validity, it can be intrusive and difficult to perform, often placing subjects in artificial settings. This artificial environment may limit the degree to which results can be generalized (External Validity). Thus, controlled experiments should be conducted, cautiously, optimizing the tradeoff between internal and external validity.

Process tracing is a particular type of field experiment in which the experimenter attempts to follow the subjects thought process through verbal protocol, information boards/folders, or eye fixation techniques. This research design has been used in the behavioral real estate domain by Diaz (1990a), Hardin (1997) and Sah (2009) to measure differences between descriptive and normative behavior. Generally, the process tracing technique suffers from similar external validity issues as other types of controlled experiments.

The survey method is a useful research method for identifying opinions or attitudes; however the respondent's answers are subject to variation based on many uncontrolled

potentially influencing factors.   Moreover, inferences regarding causality are not typically possible with the survey design.

3.3 Research Design

This study is designed as a two-factor randomized experiment to investigate the stated research hypotheses. One of the factors of interest is the impact of a previous value judgment of an anonymous expert on the appraisal process. The factor is received at three-levels: (high, low, and no reference point).   The reference point (anonymous expert's opinion of value) was administered to two broad groups (CoStar and NonCoStar groups) of subjects comprising the second factor. Thus, the experiment takes the form of a 3 x 2 design. The statistical procedures used in this study are the non-parametric Mann-Whitney U Test and the Kolmogorov-Smirnov (K-S) Test, and the parametric Analysis of Variance (ANOVA), and Student's t-test. The probability of a Type I error, is set at two conventional alpha levels 0.01, and 0.05.

The Mann-Whitney U Test is a nonparametric procedure used to test for differences in the median value between groups. The Mann Whitney U analysis begins with ranking the data and summing the ranks for each group being compared. The sum of the ranks of each group yields two "T" values (T_{group1} and T_{group2}). The Mann-Whitney U statistic can be calculated by the following equation:

$$U = T_1 - \frac{n_1(n_1+1)}{2}$$
1

where, $\frac{n_1(n_1+1)}{2}$ equals the minimum possible sum of ranks for group 1. The size of the U-statistic will determine if the group 1 median value is statistically different then expected based on the combined group 1 and group 2 values.

The Kolmogorov-Smirnov (K-S) test is a procedure that is useful to determine if two distributions were collected from the same population. The two sample K-S test is particularly useful for comparing two samples as it test for differences in both the location and shape of the cumulative distribution function (CDF). The K-S test statistic is calculated as:

$$D_{n,n'} = sup_x \left| F_{1,n}(x) - F_{2,n'}(x) \right|$$ 2

and the null hypothesis is rejected at a given alpha level if

$$\sqrt{\frac{nn'}{n+n}} \, D_{n,n'} > K_\alpha,$$ 3

where, sup_x is the supremum of the set of distances, $F_{1,n}$ and $F_{2,n'}$ are the distribution functions of the first and second sample, and K_α is the critical statistic for significance.

A Student's t-test and Analysis of Variance (ANOVA) are parametric procedures employed in this study. These tests are useful in determining if the mean between groups statistically differs. The Student's t-test for separate variance between groups can be expressed as:

$$t_{df} = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$ 4

and

$$df = \frac{\left(\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}\right)\left(\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}\right)}{\left(\frac{\left(\frac{s_1^2}{n_1}\right)}{(n_1-1)}\right)\left(\frac{\left(\frac{s_1^2}{n_1}\right)}{(n_1-1)}\right) + \left(\frac{\left(\frac{s_2^2}{n_{22}}\right)}{(n_2-1)}\right)\left(\frac{\left(\frac{s_2^2}{n_2}\right)}{(n_2-1)}\right)}$$ 5

where, S_n^2 is equal to the respective group variances, $\bar{x}_1$ and $\bar{x}_2$ are the sample group means and n_1 and n_2 are the respective group sample sizes. The size of the t-statistic will determine if the two group mean values are statistically different.

Analysis of Variance (ANOVA) is used to examine the hypothesis that means between groups are equal, and ANOVA contrast codes are used to test for specific patterns of mean differences across sample groups. The use of contrast codes tests directional hypotheses rather than only testing for differences in groups. In this analysis, the stated hypotheses are tested using the following equation:

$$V_{ij} = \mu + \alpha_i + \varepsilon_{ij} \qquad\qquad 6$$

where, V_{ij} is the j'th observation of V_i, the sample group that has received the ith level of treatment, and μ is the overall mean of V, and α_i is the deviation in that mean resulting from being in the ith treatment level. Indicator variables are added to equation 6 as exogenous variables in the ANOVA contrast code analysis. If the F-Statistic is significant then the null of equality between groups is rejected in favor of the alternate.

The sample size for this study is sixty (60) commercial appraisers, similar in size to other behavioral real estate studies involving a valuation task. A sample size of sixty (60) cases is expected to achieve a reasonable balance between research cost and statistical power. Participants were randomly assigned to two broad groups (CoStar and Non-CoStar). These broad groups were further stratified based on treatment received, the treatment comes in three forms (Low Treatment, High Treatment, No Treatment). Therefore, each group will contain 10 appraisers. The No Treatment group allows for the testing of differences between groups in the absence of treatment and also can act as a validity check to detect testing bias between the No

Treatment Costar group and the No Treatment Non-CoStar group.   Under conditions of no testing bias, the valuation estimates of the No Treatment Costar group and the No Treatment Non-CoStar group will not be statistically different. Table 1 provides a summary of the research design.

Table 1 Research Design

No. Appraisers	Treatment	Decision Support (CoStar)	No Decision Support (Non-CoStar)
20	Low Anchor	I	II
20	High Anchor	III	IV
20	No Anchor	V	VI
n=60			

The valuation task asks the participants to appraise an unimproved parcel of industrial land. Vacant industrial land was selected as the subject property because the valuation of land only requires the use of one of the three approaches to value (sales comparison approach). This simplifies the valuation problem by eliminating the need for improvement cost and rental income data.

The information contained in the valuation cases are derived from both the researcher and the CoStar dataset. Each case is divided into five sections: Problem Statement, Purpose of the Appraisal, Identification of the Subject, Neighborhood and Market Data, and Comparable Land Sales (Non-CoStar Groups). The Identification of the Subject, Purpose of the Appraisal, Neighborhood and Market Data sections were prepared by the researcher and distributed to the participants.   The subject property is identified by the street address/location, district, tax identification number, county, city, state and lot size (square feet). The purpose of the appraisal

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is to estimate the fee simple market value of the subject property as of December 31, 2008. The subject identification section describes the relevant aspects of the subject property including: land size, accessibility, ingress and egress, easements, utilities, topography, and flood and environmental information. The neighborhood section delineates the subject's market boundaries and provides an economic market outlook. It is noted that the subject property does not suffer from easements, environmental or topographical issues.

The subject property selected is located in Wilmington, Illinois. Wilmington was carefully chosen after a nationwide search to insure adequate available comparable market sales in order to facilitate the sales comparison procedure in a controlled setting. This location provided a highly comparable set of sales with no obvious pricing pattern between them; however sufficient variation in prices was present. Additionally, this location represents a market in which CoStar is established as a reliable clearinghouse for commercial property information, and is considered a decision support tool utilized by practicing commercial appraisers. The participants selected for the CoStar groups are given access to market sales data directly through CoStar COMPS Professional data service via temporary "key" codes provided by the researcher. The researcher is able to control and limit CoStar data access to the relevant location and time period. Additionally, property sales listings, specific rental data, and other possible confounding data are avoided by restricting the access to only closed transactions in the CoStar COMPS Professional dataset for the subject market. It is noted that the groups without CoStar will receive comparable sales write-ups including aerial photographs and maps so as to have the same information as CoStar users, only delivered in a different format (printed MS Word file).

CoStar is the largest provider of commercial real estate information in the U.S. and U.K., covering more than 59 billion square feet of commercial property and active in approximately 200 MSAs in the U.S. According to CoStar their data is free from bias, as CoStar does not have a direct stake in the outcome of commercial property transactions or derive any commissions from the leasing or sale of property. CoStar offers several products and services including: CoStar Property Professional, CoStar COMPS Professional, CoStar Commercial MLS, CoStar Tenant, and Market Reports. As previously mentioned, this study utilizes CoStar COMPS Professional as a decision support tool. This dataset has provided information for several recent scholarly studies published in respected journals and is deemed appropriate for the present study.[10]

CoStar COMPS Professional census approach to data collection provides comprehensive information on comparable sales transactions giving appraisers access to property comparables and the ability to track market trends. The CoStar COMPs database has more than 35 property-type filtering options (including industrial land and industrial park options), in addition to search options based on geographical characteristics (state, MSA, county, neighborhood, district). Comparable property search results can be presented in detailed, summary or tabulated formats providing flexibility to the appraiser. This tool, used as a decision support aid, will reduce effort associated with the appraisal process while providing support for property valuations. As such, it is designed primarily for commercial real estate appraiser consumption. Indeed, CoStar markets this product directly to commercial appraisers by making the contention that the use of CoStar

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[10] Real Estate Economics, Journal of Real Estate Finance and Economics, The Journal of Real Estate Research, Journal of Real Estate Portfolio Management and Journal of Retail & Leisure Properties have recently published studies utilizing the CoStar COMPS Professional dataset.

will increase appraiser confidence in their valuation decisions, yielding valuation judgments that will stand up to rigorous client reviews.[11]

3.4 Sampling procedure and operationalization

Sampling is a critical component to all research, and particularly behavioral research involving field experiments. A proper sampling strategy will help validate inferences made from the sample to the population (external validity) leading to convincing generalizations. While a variety of sampling procedures are available, i.e., simple, stratified, systematic, cluster, and multi-stage, a simple random sampling probability scheme was deemed most appropriate for this study. This sampling procedure allows reasonable generalizations from sample to population and is relatively robust across various research designs. Simple random sampling requires a sample frame to select from, which in this study was obtained from the Appraisal Institute's commercial appraiser dataset for the Atlanta-Metro area, and a procedure to ensure each case has an equal probability of being selected from the sampling frame. The sampling procedure used in this study relies on random participant assignment from the sampling frame.

A pilot study consisting of a sample of ten (10) graduate business students at Georgia State University who had recently completed graduate real estate courses, either Real Estate Development (RE 8050) or Quantitative Analysis for Real Estate (RE 8070), was conducted during December 2010 and January 2011. These students have been trained in real estate investment analysis, were familiar with CoStar, and have professional experience in the real estate field. Participation was voluntary; however a modest amount of extra credit was given to incentivize participation. The pilot study was utilized to evaluate and modify the valuation cases prior to conducting the experiment with commercial appraisers.

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[11] www.CoStar.com

The population of interest is Appraisal Institute members and Associate members. Appraisal Institute members have received the MAI designation and commercial appraisers working in an office with at least one MAI. The sampling frame for this study was obtained from the Appraisal Institute which publishes a real estate appraiser directory consisting of designated (MAI) and Associate members. The directory was filtered to only include appraisers currently employed by a real estate appraisal firm specializing in commercial valuations in the Atlanta Metropolitan Area. The research sample was then derived by random selection in the sampling frame. The selected appraisers were contacted by phone and screened for familiarity with the subject case location. If unfamiliar with the Wilmington, Illinois real estate market, then the appraiser was invited to participate in the study. The researcher also asked the selected appraiser if any coworkers would be interested in participating in the experiment. Once the numbers of participating appraisers in the selected office were determined the cases were randomly assigned to the subjects. The experiments were conducted in the subjects' offices over a four month span from January to April 2011. One appraiser who worked from his house preferred to meet at a coffee shop, providing the only out-of-office setting occurrence.

The experimental case typically took between 30 to 60 minutes to complete. The experiment was initialized with the review and signing of the subject consent form, next a brief questionnaire covering demographics and professional experience was completed. Subsequent completion of the questionnaire, the valuation case was administered to the appraiser. If the case was identified as a "CoStar" case the researcher used a "key" code provided by CoStar to log into the CoStar CoStar COMPS Professional system. A copy of the signed consent form, questionnaire and valuation cases is contained in Appendix 3, 4, and 5. Upon completion of the case, the appraiser is given an exit survey with the following questions:

1.   Please list the most important factors in determining your value estimate:

2.   Please list any information not contained in the case which would have been useful in your valuation analysis:

3.   How confident do you feel about your value estimate:

<div align="center">

Least confident   Most Confident

</div>

(Circle a number) |-------|-------|-------|-------|-------|------|-------|-------|-------|-------|

                               0   1   2   3   4   5   6   7   8   9   10

In the blanks below, show the upper and lower $/acre where you think there is a 90% probability (almost certain) that the true market value falls within this range.

$_____/acre $_____/acre $_____/acre

      (Lowest)   (Your estimate)   (Highest)

3.5 A Posteriori Research

The research experiment is designed to allow for an exploratory examination of the number of comparable sales selected for analysis in the valuation assignment across the CoStar and Non-CoStar groups and to identify subject specific determinants of biased appraisal judgments. The number of sales examined is of interest as Diaz, Gallimore and Levy (2004) find that appraisers operating in an unfamiliar geographic setting do not increase the number of sells examined compared to appraisers operating in a familiar setting when conducting an appraisal task. These findings were produced by appraisers without access to CoStar. Even though this study is not designed to test for differences between groups in unfamiliar and familiar locations, the idea that the use of a decision support tool (CoStar) may increase the sales examined compared to a control group receiving the same relevant sales information but in a different

format is explored. An examination of this question is conducted using the Students t-test, K-S test, and the Mann-Whitney test, as described previously.

Next, a series of parsimonious regressions are modeled to examine the significance of relationships between the appraised value and a set of potential subject specific explanatory variables. A priori hypotheses are absent, but a parsimonious set of endogenous variables were selected to gain perspective on the relationship between the appraised value and a set of subject specific professional and demographic characteristics when controlling for the treatment effect. Two OLS regressions were modeled for this analysis. The first regression will contain the control and high anchor groups for both the CoStar and Non-CoStar broad groups (n=40) and the second regression will contain the control and low anchor groups for both the CoStar and Non-CoStar broad groups (n=40). The regression models can be expressed as:

$$V_{Gi} = \alpha_i + \beta_1 Gender + \beta_2 Exp. + \beta_3 MAI + \beta_4 Regional + \beta_5 Mort.lend. + \beta_6 Control + \varepsilon_{it} \qquad 7$$

where, V_{Gi} is the subject property appraised value for each appraiser, $Gender$ is subject gender, $Exp.$ is months of commercial appraisal experience, MAI indicator of MAI designation, $Regional$ is geographic territory covered, $Mort.lend.$ is an indicator variable for appraisers with 70% or more assignments from mortgage lenders, and $Control$ is an indicator for the group not receiving treatment. A statistically significant parameter estimate would indicate a structural relationship with the appraised value controlling for the treatment effect.

3.6 Validity Issues
The present study is a two-factor randomized controlled experimental design investigating the debiasing affect of a decision support tool on the impact of an anonymous expert's value opinion on real estate appraisals. Although all research methods are fallible

suffering from threats to validity, if carefully crafted, experiments can be designed in order to subdue these threats and improve causal inferences. Validity can be disaggregated into four types, each addressing a specific concern. The four validity types are identified as: statistical conclusion, internal, construct and external validity.

Statistical conclusion and internal validity are concerned with detecting a relationship and if present, causality between the variables. More specifically, statistical conclusion validity is concerned with detecting a relationship, whereas internal validity is concerned with the causal (cause-effect) structure of the relationship. Both statistical conclusion and internal validity are subject to numerous threats. Two types of errors are associated with statistical conclusion validity (Type 1 and Type II Error). Type I error is associated with finding a relationship between variables in a sample, when in fact one does not exist in the population. Type II error is not finding a relationship in the sample when one exists in the population (i.e. failing to reject a false null hypothesis). While the alpha level or significance level is the Type I error probability, Type II error can be reduced by increasing statistical power. Statistical power is the ability to correctly conclude that there is a relationship between two variables, and is the largest threat to statistical conclusion validity. Statistical power is maximized in this study by sampling an adequate number of subjects derived through random sampling, operationalizing the experiment in a consistent manner, and keeping the random irrelevancies to a minimum by carrying out the experiment in a setting familiar to the subject.

Internal validity is highly relevant in this study as the presence of a causal relationship between a treatment (expert opinion of value) and real estate value estimates is examined. The experimental design was carefully designed to control for the primary threats to internal validity. Testing across participants occurred in a three-month time period to control for potential

exogenous influences on property values. Additionally, all appraisers are valuing the same property in an unfamiliar market to avoid preconceptions from prior valuation experience. This is operationalized, similarly to Diaz (1997), Diaz and Hansz (1997) and Diaz and Hansz (2001), by asking appraisers in the Atlanta, Georgia metropolitan statistical area (MSA) to perform an appraisal on industrial land property in an unfamiliar location (Wilmington, Illinois). Random assignment of participants to control and treatment groups will help to counterbalance remaining threats due to differences in experience or history between sample groups.

Additionally, the control group with CoStar access and the control group without CoStar access are tested for differences across values as a validity control measure. Testing the difference in central tendency as well as the CDF between the CoStar control group and the Non-CoStar control group of appraisers will reveal if a bias exist between groups. In this study, the null hypothesis that $CS_C = NCS_c$ is not rejected suggesting that testing bias is not a concern. Mortality and regression to the mean are not a concern to the validity of this particular experiment as participants are randomly assigned to groups and substantial participant drop-out did not occur.

Statistical conclusion and internal validity refer to a research design which operationalizes the theoretical construct through implemented programs, treatments, measurements and observations. Whereas, Construct validity refers to the reliability of inferences derived through the operationalization of a study. So, of primary concern to construct validity is the concept that the operationalization of the study measured what we intended it to measure. If construct validity is present then valid inferences from the operationalization of the study can be made to the theoretical constructs providing the foundation for the study. Standardization and written protocols used in this experiment served to shield participants from

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cues (subconscious and conscious) revealing researcher expectations possibly resulting in the participant(s) trying to react in ways in which they believe will be pleasing to the researcher. The instructions, statement of test problem, and administered treatment given to participants was written, standardized and randomly assigned.

External validity is the extent to which conclusions derived from the sample are generalizeable to contexts outside the specific study (Cook and Campbell, 1979; Shadish, Cook, and Campbell, 2002). Glass (1968) contends that external validity is related to the correspondence between samples and representative populations upon which generalization is required. If external validity is weak extrapolation of the findings outside of the study may lead to erroneous conclusions. In this study, the narrow description of the population and randomized sampling from within this population serve to increase generalizability. Random sampling of appraisers across heterogeneous valuation companies will produce a cross section of appraisers which will correspond to the targeted population and allow for inferential deductions. The external validity in this study is a substantial improvement over previous studies because the subject property and sales comparables that comprise the real estate case are actual "real world" properties. Additionally, the experiments were primarily conducted in the appraiser's office as opposed to an artificial "laboratory" setting.

In summary, the experimental design was carefully crafted as to minimize potential threats to validity. The tradeoffs between the various threats to validity have been considered and optimized in the present study.

Chapter Four

Analysis of the Experimental Data

This chapter presents the analyses of the data collected from the experiment described in Chapter 3. First, descriptive data and statistics are presented for the aggregated sample and then disaggregated for cell comparisons. Second, the research hypotheses are examined to determine if they are supported by the experimental data. Then, additional posteriori comparisons are examined for possible significant relationships within the experimental data collected.

4.1 Sample Participant Profile

This section provides information on the participants in the experiment including demographic, professional, and geographical characteristics. There were a total of 60 participants averaging 40.2 years of age, with eight (13.3%) being female. At the time of the experiments, all of the participants were employed as commercial appraisers in the Atlanta, Georgia Metropolitan Area. Their real estate activity is exclusively commercial (100%), primarily with mortgage lender clients (62.2%). The subjects' average 11.8 years of experience in the real estate valuation profession with 18 subjects (30%) having obtained the MAI (Member of the Appraisal Institute) designation. They were diversified across firms with 18 firms represented in this study, for an average of 3.33 participants per firm. The participating firms range in size from Atlanta-based sole proprietors to large international valuation groups with local offices in Atlanta consisting of 25 or more commercial appraisers.

The subjects were also diversified in the geographic territory in which they routinely covered, 44.3% were regional or national in scope, and 33.7% and 22.0% covered only Metropolitan Atlanta and Georgia, respectively. None of the appraisers interviewed were either

familiar with the Wilmington, Illinois real estate market, or have had recent appraisal assignments in Wilmington, Illinois. Table 4 provides an overview of the sample participant profile.

Table 4 Sample participant Profile

	CS$_C$	CS$_L$	CS$_H$	NCS$_C$	NCS$_L$	NCS$_H$	Total
Appraisers Interviewed	10	10	10	10	10	10	60
Demographic Data							
Gender (percent female)	20.0%	10.0%	10.0%	20.0%	0.0%	20.0%	13.3%
Age	43.2	39.5	38.1	40.0	41.0	40.0	40.3
Professional							
Percentage Commercial	100%	100%	100%	100%	100%	100%	100%
Experience in Profession (yrs)	12.95	9.76	10.34	12.14	15.06	10.7	11.8
Percentage MAI	40.0%	20.0%	30.0%	30.0%	30.0%	30.0%	30.0%
Percentage Lender Clients	63.0%	66.3%	40.9%	52.4%	75.7%	75.0%	62.2%
Geographic Area Covered							
Metro Atlanta	30.0%	40.0%	20.0%	30.0%	22.2%	60%	33.7%
Georgia	30.0%	20.0%	20.0%	20.0%	22.2%	20%	22.0%
Regional/National	40.0%	40.0%	60.0%	50.0%	55.5%	20%	44.3%

Notes: CS$_C$ = CoStar Control group; CS$_L$ = CoStar Low Anchor group; CS$_H$ = CoStar High Anchor group; NCS$_C$ = Non-CoStar Control group; NCS$_L$ = Non-CoStar Low Anchor group; NCS$_H$ = Non-CoStar High Anchor group

4.2 Experimental Data

The experiment participants were randomly divided into two broad groups (CoStar Access and No CoStar Acess) and three sub-groups (Control, High Anchor, and Low Anchor). Combined this represents six categories: CS$_C$ = CoStar Control group; CS$_L$ = CoStar Low Anchor group; CS$_H$ = CoStar High Anchor group; NCS = Non-CoStar Control group; NCS$_L$ = Non-CoStar Low Anchor group; NCS$_H$ = Non-CoStar High Anchor group.

The CoStar low valuation group and the CoStar high valuation group consists of two groups of appraisers each receiving information regarding an anonymous expert's (MAI) opinion of value on the subject property. This value estimate was either artificially set too low or too high depending on the group, as to induce and detect a heuristic response. The mean/median sales price produced by these groups is $91,000/$90,000 (low anchor) and $103,000/$105,000 (high anchor). The values range from $70,000 to $120,000 and $80,000 to $120,000 respectively, suggesting a large variation in value opinions. The standard deviations are $17,764 for the group receiving a low anchor and $13,984 for the group receiving a high anchor.

The skewness and kurtosis are examined to gain insights into the sample frequency distribution which may determine the appropriate inferential procedure(s) to employ. The distribution produced by the low treatment CoStar group is moderately positive skewed and asymmetric, however the group receiving the high treatment is slightly negatively skewed but also asymmetric. Also, both groups exhibit a platykurtic or flat distribution, making a case for nonparametric inferential procedures.

The Non-CoStar low valuation group and the Non-CoStar high valuation group were provided the same content as the previous CoStar groups except the participants were not allowed access to CoStar. Instead, the content was delivered via written comparable sales reports. The mean/median sales price produced by these groups is $90,500/$90,000 (low anchor) and $106,000/$110,000 (high anchor). The values range from $70,000 to $120,000 and $85,000 to $120,000 respectively, again suggesting substantial variation in appraiser value estimates. The standard deviations are $16,574 for the group receiving a low anchor and $9,944 for the group receiving a high anchor.

An examination of the skewness and kurtosis reveal the distribution produced by the Non-CoStar high treatment group is moderately negative skewed and the low treatment group is slightly positive skewed, (i.e. same direction as the CoStar groups). Both high and low treatment groups exhibit some degree of non-normal kurtosis, and consistent with the CoStar group these findings suggest the need for distribution-free inferential procedures.

The CoStar and Non-CoStar control groups were used as: 1) a validity control to detect the presence of any testing bias between the broad (Costar and Non-CoStar) groups, and 2) for comparison purposes within the broad groups. The mean/median sales price produced by these groups is \$102,500/\$102,500 (CoStar) and \$104,000/\$100,000 (Non-CoStar). The values range from \$70,000 to \$120,000 and \$75,000 to \$120,000, respectively. The standard deviations are \$16,874 for the CoStar group and \$13,292 for the Non-CoStar group. The distributions of both are slightly asymmetrical, being moderately negative skewed. The CoStar group does not suffer from a problem with kurtosis; however the Non-CoStar group's sample distribution exhibits leptokurtosis. Taken collectively with previous results, these findings suggest the need for non-parametric statistical test. Table 5 provides the experimental value estimates segmented based on sample groups and the related descriptive details.

Table 5 Experimental Data

	CS_C	CS_L	CS_H	NCS_C	NCS_L	NCS_H
Observations (1-6)	70000	70000	80000	75000	70000	85000
Observations (7-12)	80000	75000	90000	100000	70000	100000
Observations (13-18)	100000	75000	90000	100000	75000	100000
Observations (19-24)	100000	80000	95000	100000	85000	100000
Observations (25-30)	100000	90000	100000	100000	90000	110000
Observations (31-36)	105000	90000	110000	100000	90000	110000
Observations (37-42)	110000	90000	110000	110000	95000	110000
Observations (43-48)	120000	100000	115000	115000	100000	110000
Observations (49-54)	120000	120000	120000	120000	110000	115000
Observations (55-60)	120000	120000	120000	120000	120000	120000
Mean (price/acre)	102500	91000	103000	104000	90500	106000
Median (price/acre)	102500	90000	105000	100000	90000	110000
Standard Deviation	16874	17764	13984	13292	16574	9944
Kurtosis	0.12	-0.48	-1.29	1.64	-0.52	1.11
Skewness	-0.85	0.76	-0.25	-0.89	0.39	-0.87
Minimum	70000	70000	80000	75000	70000	85000
Maximum	120000	120000	120000	120000	120000	120000
Range	50000	50000	40000	45000	50000	35000
Total Observations (n=60)	10	10	10	10	10	10

Notes: CS_C = CoStar Control group; CS_L = CoStar Low Anchor group; CS_H = CoStar High Anchor group; NCS_C = Non-CoStar Control group; NCS_L = Non-CoStar Low Anchor group; NCS_H = Non-CoStar High Anchor group

4.3 Examination of the Research Hypotheses

The experimental data was analyzed using a combination of nonparametric and parametric statistical tests. The parametric procedures used in this study are the Student's t-test and ANOVA. These statistical tests require several underlying assumptions that must be satisfied

including normality of the sampling distributions and equality of variance. The ANOVA and Student's t-test parameter estimates follow an F-distribution and t-distribution respectively, allowing the use of the either the F-distribution or t-distributions to test hypotheses over the population parameters with our sample statistics if the normality and variance assumptions are met.

The t-distribution is robust to non-normality if the sample size is sufficiently large, but problems may occur in small samples such as the dataset used in this study. The F-test is not robust to normality, but robust to non-equality of variance if the samples being compared contain the same number of observations. Nonparametric (distribution-free) techniques were employed as robustness measures to the parametric procedures. The non-parametric techniques utilized are the Mann-Whitney U Test and the Kolmogorov-Smirnov (K-S) Test. The Mann-Whitney is a test of central tendency (median) between two samples and the K-S test determines the likelihood of the two sample distributions coming from the same population.

As an internal validity check the CoStar control group was compared with the Non-CoStar control group for differences across medians, variances, and distributions. In all cases the null hypothesis (Ho: $CS_C = NCS_C$) is not rejected. Thus, the CoStar and the Non-CoStar groups are considered to be similar in the absence of a treatment. In addition, results from the F-tests suggest that there is not a statistical difference in the variances between groups with alpha levels set at 5%.

The following research hypotheses are examined:

Research Hypothesis 1: There will be no valuation differences detected between subject groups when they utilize CoStar as a decision support tool.

Test Hypotheses for Research Hypothesis 1:

a. Ho_{1a}: $CS_C = CS_L = CS_H$ $\qquad$ Ha_{1a}: $CS_C \neq CS_L \neq CS_H$

b. Ho_{1b}: $CS_C = CS_L$ $\qquad$ Ha_{1b}: $CS_C \neq CS_L$

c. Ho_{1c}: $CS_C = CS_H$ $\qquad$ Ha_{1c}: $CS_C \neq CS_H$

d. Ho_{1d}: $CS_L = CS_H$ $\qquad$ Ha_{1d}: $CS_L \neq CS_H$

In all cases the null is not rejected at the 5% level with all parametric and non-parametric procedures. These findings support the research expectation of no differences between control and treatment groups when participants receive CoStar access.

Research Hypothesis 2a: There will be valuation differences detected between subject groups when they are not allowed to use CoStar as a decision support tool.

Ho_{2a}: $NCS_C = NCS_L = NCS_H$ $\qquad$ Ha_{2a}: $NCS_C \neq NCS_L \neq NCS_H$

Since the participants for these groups are not allowed access to the decision support tool (CoStar), the research expectation is to reject the null hypothesis in favor of the alternate. The null hypothesis is rejected with a significance value of 1.7% for the ANOVA analysis. This finding supports the research expectation by rejecting the null hypothesis.

Research Hypothesis 2b: Compared to a Non-CoStar control group of appraisers receiving no treatment, a Non-CoStar treatment group receiving a low anchor value in the form of a value opinion of an anonymous expert will yield lower valuations.

Ho_{2b}: $NCS_C \leq NCS_L$ $\qquad$ Ha_{2b}: $NCS_C > NCS_L$

The null hypothesis is rejected with significance values of 3.0% and 1.7% respectively for the parametric tests. The non-parametric Mann-Whitney test with a significance level of 2.1% also rejects the null hypothesis. The K-S test resulted in a significance value of 2.8%., suggesting that the sample group distributions do not come from the same population. These findings support the research expectation by rejecting the null hypothesis.

Research Hypothesis 2c: Compared to a Non-CoStar control group of appraisers receiving no treatment, a Non-CoStar treatment group receiving a high anchor value in the form of a value opinion of an anonymous expert will yield higher valuations.

$Ho_{2c}: NCS_C \geq NCS_H$ $\qquad\qquad\qquad$ $Ha_{2c}: NCS_C < NCS_H$

The null hypothesis is not rejected with significance levels of 35.4%, 37.2% and 37.6% for the t-test, Contrast Codes, and Mann-Whitney, respectively. Also, the result from the K-S test suggests that the two sample group distributions come for the same population.

Research Hypothesis 2d: Compared to a Non-CoStar group of appraisers receiving a low anchor value in the form of a value opinion of an anonymous expert, a Non-CoStar group receiving a high anchor value in the form of a value opinion of an anonymous expert will yield higher valuations.

$Ho_{2d}: NCS_L \geq NCS_H$ $\qquad\qquad\qquad$ $Ha_{2d}: NCS_L < NCSH$

The null hypothesis is rejected with significance values of 1.1%, 0.8% and 1.5% for the parametric t-test, Contrast Codes, and the non-parametric Mann-Whitney test, respectively. The K-S test resulted in a significance value of 2.8%, suggesting that the sample group distributions

do not come from the same population. These findings support the research expectation by rejecting the null hypothesis.

Research Hypothesis 3a: Compared to a Non-CoStar group of appraisers receiving a low anchor value in the form of a value opinion of an anonymous expert, a group of appraisers utilizing CoStar and also receiving the same low anchor value will yield higher valuations.

$Ho_{3a}: NCS_L \geq CS_L$ $\qquad\qquad\qquad$ $Ha_{3a}: NCS_L < CS_L$

Although the results were in the expected direction, the null hypothesis was not rejected. The parametric t-test and the non-parametric Mann-Whitney test yielded significance levels of 47.4% and 48.5%, respectively. The result from the K-S test also suggests that the two sample group distributions come for the same population.

Research Hypothesis 3b: Compared to a Non-CoStar group of appraisers receiving a high anchor value in the form of a value opinion of an anonymous expert, a group of appraisers utilizing CoStar and also receiving the same high anchor value will yield lower valuations.

$Ho_{3b}: NCS_H \leq CS_H$ $\qquad\qquad\qquad$ $Ha_{3b}: NCS_H > CS_H$

The null hypothesis is not rejected with significance levels of 29.4% and 35.0% for the parametric t-test, and the non-parametric Mann-Whitney test, respectively. The result from the K-S test suggests that the two sample group distributions come for the same population. Table 6 summarizes the experimental results for the tested hypotheses and internal validity check.

Table 6 Experimental Results, 1-tailed significant values unless indicated otherwise

		t-test	Mann-Whitney U	ANOVA	K-S	F-Test
Hypotheses 1						
RH1a	$\mathbf{CS_c = CS_L = CS_H}$	n/a	n/a	0.098	n/a	0.472
RH1$_b$	$\mathbf{CS_c = CS_L}$	0.078	0.068	0.063	0.082	0.440
RH1$_c$	$\mathbf{CS_c = CS_H}$	0.472	0.439	0.473	0.494	0.292
RH1$_d$	$\mathbf{CS_L = CS_H}$	0.056	0.054	0.056	0.200	0.244
Hypotheses 2						
RH2$_a$	$\mathbf{NCS_C \neq NCS_L \neq NCS_H}$	n/a	n/a	**0.017***	n/a	
RH2$_b$	$\mathbf{NCS_c > NCS_L}$	**0.030***	**0.021***	**0.017***	**0.028***	0.261
RH2$_c$	$\mathbf{NCS_c < NCS_H}$	0.354	0.376	0.372	0.494	0.200
RH2$_d$	$\mathbf{NCS_L < NCS_H}$	**0.011***	**0.015***	**0.008****	**0.028***	0.072
Hypotheses 3						
RH3$_a$	$\mathbf{CS_L > NCS_L}$	0.474	0.485	n/a	0.500	0.420
RH3$_b$	$\mathbf{CS_H < NCS_H}$	0.294	0.350	n/a	0.380	0.162
Validity						
2-tailed test	$\mathbf{CS_c = NCS_c}$	0.828	0.937	n/a	1.00	0.244

Notes: CS_C = CoStar Control group; CS_L = CoStar Low Anchor group; CS_H = CoStar High Anchor group; NCS_C = Non-CoStar Control group; NCS_L = Non-CoStar Low Anchor group; NCS_H = Non-CoStar High Anchor group. *indicates significance at the 5% level; **indicates significance at the 1% level

In summary, when examined in isolation the hypothesis that there will be no valuation differences detected between subject groups when they utilize CoStar as a decision support tool is supported with alpha levels set at 5%. Statistical differences between groups is not detected in the ANOVA analysis (RH1$_a$), as the null is not rejected. When the low and high reference point

CoStar groups are compared to a CoStar control group receiving no anchor ($RH1_b$ and $RH1_c$) statistical differences between groups is not detected across all tests employed. Similarly, when comparisons are made between the CoStar low and high reference point groups ($RH1_d$) statistical differences between groups is not detected. Research hypotheses $RH2_a$, stating that when participants are not allowed access to CoStar differences between groups will exist is supported as the null of no difference is rejected. $RH2_b$, and $RH2_d$ stating that appraisers without access to CoStar will be influenced by the references points are supported across all statistical procedures. Research hypothesis $RH2_c$ is not supported however as the null could not be rejected. Appraisers in this study respond asymmetrically to reference points with a lower reference point exhibiting a greater impact. Finally, although the results are in the expected direction the statistical tests employed do not provide support for research hypotheses $RH3_a$ and $RH3_b$ as the null of equality is not rejected in both cases when the CoStar and Non-CoStar groups are directly compared. Implications from the experimental findings, along with future research potential, are discussed further in Chapter 5.

4.4 A Posteriori Analyses

In this section exploratory research is conducted to examine the determinants of biased appraisal judgments. The research study was designed to allow for a posteriori analysis on selected relationships. First, the number of comparable sales selected for analysis in the valuation assignment is compared across groups with CoStar access and groups without CoStar access. Next, potential explanatory variables are examined across participants to detect the presence of factors leading to greater anchoring susceptibility among appraisers.

An examination of the number of comparable sales considered in the appraisal analyses revealed that when comparing the combined group with CoStar access with the combined group

without CoStar access, the group with CoStar access reported an average of 1.3 more comparable sales considered in the appraisal analyses. This difference is significant at a 1% level (p-values = 0.000 & 0.000) using both a t-test and Mann-Whitney test. These findings are robust when parceling the groups based on treatment (or lack of treatment) received. When comparing the CoStar Control and the Non-CoStar Control group, the Costar Control group used a statistically significant number (1.7) of additional sales in the appraisal analyses. Similarly, the CoStar Low Anchor group used an additional 1.5 comparable sales in the analyses with the difference being significant at the 1% level. There was not a significant difference detected, at the 5% level, between the two groups with high anchor values, but the absolute difference indicates that the CoStar High Anchor group used an average of 0.7 additional sales in the analyses. The results of this analysis are reported in Table 7.

Table 7 Analysis of comparable sales selected for valuation analysis, two tailed test

	CoStar Control group	Non-CoStar Control group	t-test	Mann-Whitney
Mean	6.0	4.3	**0.002****	**0.005****
	CoStar Low Anchor group	Non- CoStar Low Anchor group	t-test	Mann-Whitney
Mean	5.6	4.1	**0.001****	**0.003****
	CoStar High Anchor group	Non-CoStar High Anchor group	t-test	Mann-Whitney
Mean	5.3	4.6	0.080	0.194
	Combined CoStar	Combined Non-CoStar	t-test	Mann-Whitney
Mean	5.6	4.3	**0.000****	**0.000****

Notes: *indicates significance at the 5% level; **indicates significance at the 1% level

Next, a series of parsimonious regressions are modeled to examine the significance of relationships between the appraised value and a set of potential explanatory variables. The variables analyzed are: Gender (*Gender*), Months Experience in the Appraisal Profession (*Exp.*), Regional in Scope (*Regional*), Mortgage Lender Clients (*Mort. Lend.*), CoStar Groups (*CoStar*) and Control Group (*Control*). *Gender* is an indicator variable representing females, *MAI* is an indicator variable representing appraisers holding the MAI (Member Appraisal Institute) designation, *Regional* is an indicator variable representing appraisers who reported their geographic territory covered is regional, and *Mort. Lend.* is an indicator variable representing appraisers with 70% or more of their assignments from mortgage lenders. *CoStar* is an indicator variable distinguishing the CoStar groups from the non-CoStar groups, and *Control* is an indicator variable distinguishing the control group from the applicable treatment group. Although a priori hypotheses are absent, theses independent variables were selected to gain insight into appraiser demographic and professional characteristics which might prove to be moderating attribute(s) in the presence of potentially bias influences of previous value opinions on appraisers.

Table 8 presents the results of the regressions. The first column combines the groups receiving high treatment with the control groups (n=40). Therefore, if any of the exogenous variables exhibited a resistance to the treatment a significant negative parameter estimate would be detected. Similarly, the second column combines the low treatment with the control groups (n=40), so a moderating variable would exhibit a positive coefficient. The regression results did not detect the presence of a moderating variable, suggesting that the influential potential of reference points is robust across a diverse array of attributes.

Table 8 OLS regressions examining heuristic influence on possible explanatory variables

	Control & High Anchor Groups		Control & Low Anchor Groups	
	Coefficient	t-stat	Coefficient	t-stat
Constant	104210.54**	(19.23)	88183.41**	(13.67)
Gender	571.97	(0.10)	3040.53	(0.37)
Exp.	15.28	(0.43)	29.23	(0.76)
MAI	2612.37	(0.38)	-1463.58	(-0.15)
Regional	698.35	(0.14)	3451.32	(0.64)
Mort. Lend.	-5580.99	(-1.08)	-5309.59	(-0.94)
Control	-1814.00	(-0.41)	11671.91*	(2.10)
R^2	0.079		0.210	
F-Stat	0.475		1.416	

Notes: *Gender* is an indicator variable representing females, *MAI* is an indicator variable representing appraisers holding the MAI (Member Appraisal Institute) designation, *Regional* is an indicator variable representing appraisers who reported their geographic territory covered is regional, and *Mort. Lend.* is an indicator variable representing appraisers with 70% or more of their assignments from mortgage lenders. *Control* is an indicator variable distinguishing the control group from the applicable treatment group. *indicates significance at the 5% level; **indicates significance at the 1% level

Chapter 5

Conclusions and Future Research Considerations

This chapter presents a discussion of the analyses presented in Chapter 4, and future research applications. First, the results and implications of this study are discussed in a broad behavioral real estate context. Then, future research extensions are framed in a debiasing theme.

5.1 Discussion of Analyses

In this dissertation, the use of a decision support tool (CoStar) is examined to determine if its use is an effective technique to help appraisers' decision making process approach normative standards when conducting an appraisal. The real estate literature is rich with studies documenting non-normative descriptive appraiser behavior, including deviations from the normative appraisal model as a result of heuristic inclinations. In many of these studies, the use of heuristics has lead to systematic bias or judgmental errors in valuation estimates.

The employment of a heuristic often times is the result of market uncertainty. Quan and Quigly (1991) and Geltner (1993) have theorized that appraisers increasingly rely on previous value judgments in the face of greater uncertainty. Diaz and Hansz (1997) suggest that market uncertainty may induce the use of an unsanctioned reference point (previous value opinion of an anonymous expert) that would not otherwise impact judgments. Levy and Schuck (1999) suggest that a lack of reliable data increases the likelihood of appraisal error and increases appraiser susceptibility to a nonsanctioned influence. And, commercial appraisers would be more comfortable in their value estimates and less susceptible to influence if appraisers had access to in-depth transactional details.

CoStar provides commercial real estate appraisers with efficient access to comprehensive market data and the technical ability to quickly analyze and aggregate data efficiently. The use of CoStar as a decision support tool reduces informational search and processing cost. And, when used in areas of geographic unfamiliarity it has the potential to reduce market uncertainty. Therefore, when used in areas of geographic unfamiliarity CoStar has the potential to subdue or eliminate the reliance on non-sanctioned heuristics.

In the context of this study, the heuristic selected is "anchoring and adjustment" and the anchor or reference point utilized to examine the debiasing potential of an external decision tool is the previous value opinion of an anonymous expert. This value anchor was selected because previous research has illustrated that expert appraisers operating in an area of geographic unfamiliarity may be influenced by the previous value opinions of other anonymous experts, and compared with other anchors (i.e. comparable contract price and contract price of subject) expert opinions impacted the appraised value the least, although statistically significant. Thus, in examining the effectiveness of a debiasing tool (CoStar), subjects given previous value opinions of expert appraisers when charged with an appraisal task would be the most susceptible to being debiased. If decision support tools are to be successful in debiasing appraisers then it should be detected with this anchor.

When examined in isolation, I find evidence that the use of CoStar may subdue heuristic influence on appraisers and produce more normative induced decision strategies. The groups given CoStar access receiving the high and low treatments respectively were not statistically different than the control group, at a Type I error rate of 5%. Similarly, when directly comparing the CoStar high and low groups the null of no difference is not rejected. The results from the groups without CoStar access were mixed as appraisers responded asymmetrically to the

treatment. The group receiving the low treatment was statistically different than the control group; however the group receiving high treatment was not statistically different than the control group. When the low and the high Non-CoStar groups were directly compared the null is rejected, suggesting the group values differ. These findings are robust across parametric mean difference tests and non-parametric median and sample distribution tests. Additionally, the ANOVA analysis across all Non-CoStar groups resulted in rejecting the null hypothesis of equality providing evidence that the values between these groups without access to CoStar differ. However, the null was not rejected when performing the same analysis (ANOVA) across all CoStar groups.

An examination of the relationships between professional and demographic participant attributes, and the valuation outcome did not reveal any significant relationships. It would appear that the pervasiveness of heuristic influence is robust across a diverse set of participant attributes.

Overall, the results from the separate CoStar and Non-CoStar analyses suggests that the groups operating without CoStar access tended to exhibit greater susceptibility to the influence of an anonymous expert's value opinion. However, when the CoStar groups receiving low (high) treatment were directly compared to the Non-CoStar groups receiving the same low (high) treatment, the results were in the expected direction but not statistically different at conventional alpha levels. Therefore when the CoStar and Non-CoStar group values were directly compared the null of no difference could not be rejected. The groups with access to CoStar did, however, select a statistically larger number of comparable sales for analysis in the valuation assignment. Diaz, Gallimore, and Levy (2004) suggest that appraisers should increase the amount of comparable sales used in the valuation assignment in unfamiliar geographic markets as to gain

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more market knowledge and to reduce uncertainty. However, they find that appraisers without access to CoStar and operating in areas of geographic unfamiliarity do not increase sales search relative to a group of appraisers operating in areas of high geographic familiarity. In the present study, appraisers with CoStar access consistently included a larger number of comparable sales in the appraisal analysis, with the CoStar control group examining an average of 1.7 additional sales (p-value 0.000) compared to the Non-CoStar control group. The result is interesting as it appears that CoStar encourages appraisers to examine a greater number of comparable sales when engaged in the appraisal task. CoStar offers appraiser controlled informational displays and filtering techniques which reduce cognitive effort when examining comparable sales possibly resulting in a larger number of comparable sales (information) analyzed.

The research experiment was also designed to detect the presence of asymmetries in responses between the groups receiving either the low or high treatments. I find that the impact of the treatment is not symmetric. Subjects receiving the low anchor treatment responded with lower valuation judgments than the control groups. However, groups receiving the high anchor treatment did not seem to significantly produce higher values than the control groups. Although this study's design and research questions differed from the Hansz and Diaz (2001) study, the asymmetric finding in the present study provides some support to the contention made by Hansz and Diaz (2001) that anchoring is a "routinized response to pervasive agent-client concerns".

The author's theorized that the asymmetric response is likely to be dynamic with appraiser susceptibility to either high or low market feedback dependent on client concerns as opposed to a real estate optimism bias. Hansz and Diaz conducted their market feedback study in a time period of gradual real estate price appreciation where appraisal judgments that are too

high were rarely of concern to clients; they find that appraisers during that time period were more susceptible to feedback which produced higher valuation judgments. This study test a similar contention only in a climate with falling real estate values, and finds appraisers to be more susceptible to anchors producing lower valuation judgments. This finding coupled with Hansz and Diaz's (2001) finding strengthens the argument that appraiser susceptibility to influence is dynamic and conditioned upon pervasive agent-client concerns.

5.2 Future Research Considerations

Behavioral real estate research is rich with studies documenting appraiser susceptibility to heuristic influence, often times resulting in biased valuation judgments. The quest to identify successful debiasing strategies is an emerging research paradigm in many of the social sciences. The present study provides the first attempt at debiasing appraiser judgments through the use of an external decision support tool, however many questions remain for future research examination. A similar methodology or a process tracing technique can be used to examine the efficacy of debiasing strategies on the appraisal and comparable sales selection processes. Additionally, extensions to client valuation feedback would contribute to the client-agent literature.

The use of CoStar may help increase the efficiency of the information-processing technique that expert real estate appraiser's exhibit when selecting comparable sales. This may lead appraisers operating in geographically unfamiliar areas to increase the amount of sales examined relative to work performed in familiar markets, since little cognitive effort would be required using CoStar. A research design similar to Diaz, Gallimore, and Levy (2004) would provide insight in this area. This topic could further be investigated with a cross-cultural

examination similar to Wolverton (1996) and Gallimore and Wolverton (1997). This type of analysis may provide interesting comparisons between US appraisers with CoStar access and their European valuer counterparts.

The topic of client feedback is also a relevant and debated topic in the lending and appraisal industries. Gallimore and Wolverton (2000) and Wolverton and Gallimore (1999a) illustrate the prevalence of client feedback in the real estate appraisal domain.   Roberts and Roberts (1991) suggest that client influence is the largest source of systematic bias resulting in appraisal judgment error.   Cole (1988) contends that client feedback is a component of the appraisal smoothing phenomena.   While, Diaz and Hansz (2010) surmise that the influence derived through client feedback render the gate-keeping role of appraisers in the appraiser-lender relationship acutely ineffective.   A study investigating the impact of client feedback on the appraisal process in the presence of a debiasing technique would be a timely research topic.

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Figures

Figure 1: RE Loans all Commercial Banks (Trillion US $)
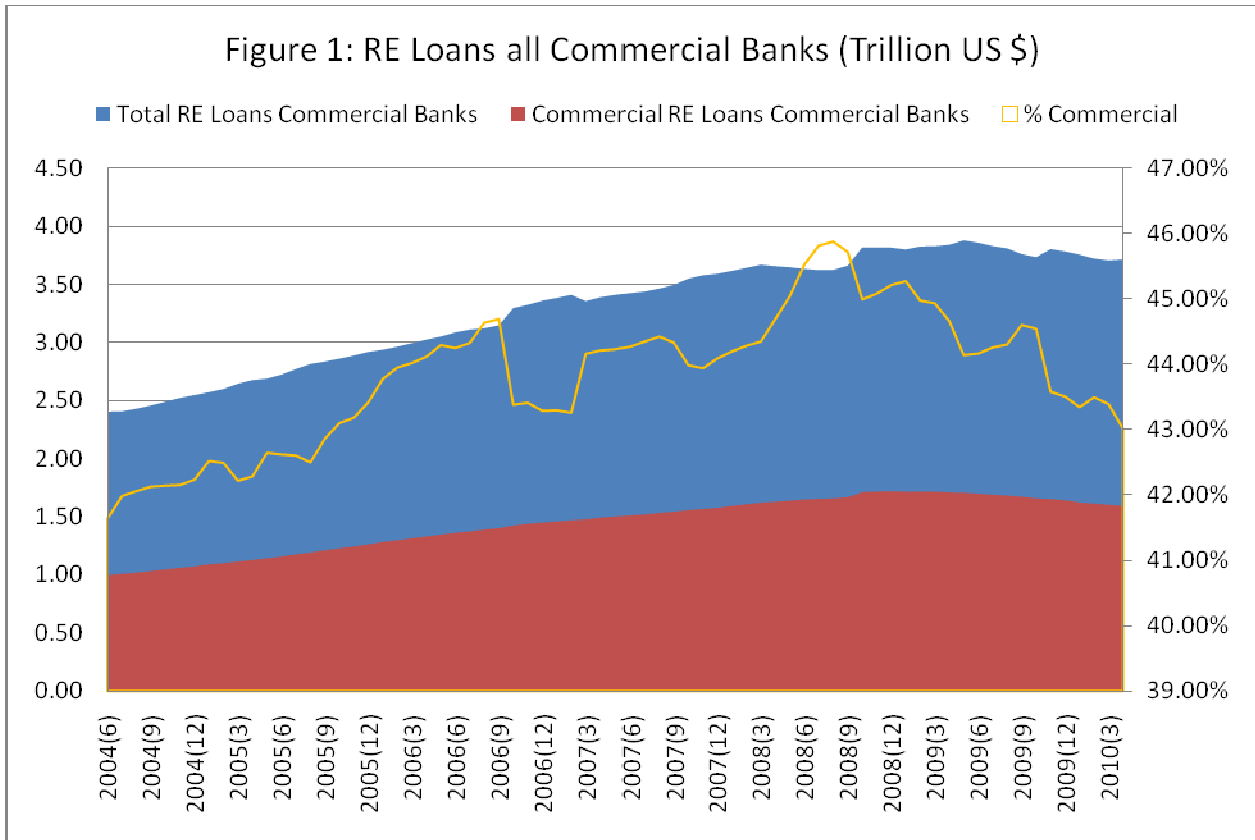
Figure 2: Commercial Bank Delinquency Rate

Legend:
- Total Loans
- Total loans Secured by Real Estate
- Single Family Residential Mortgages
- Commercial Real Estate Loans
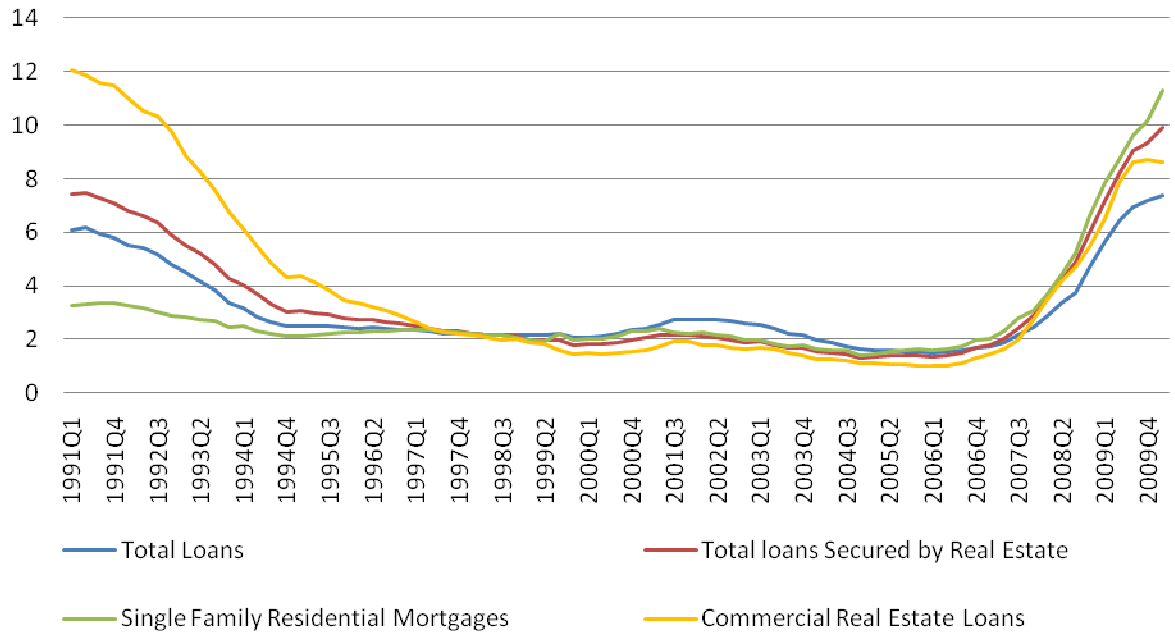
Figure 4: Total Private New Construction (Billion US $)

1200

1000

800

600

400

200

0

1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010

— Total Private Construction in Billions of dollars

— Total Private Residential Construction in Billions of dollars

— Non-Residential
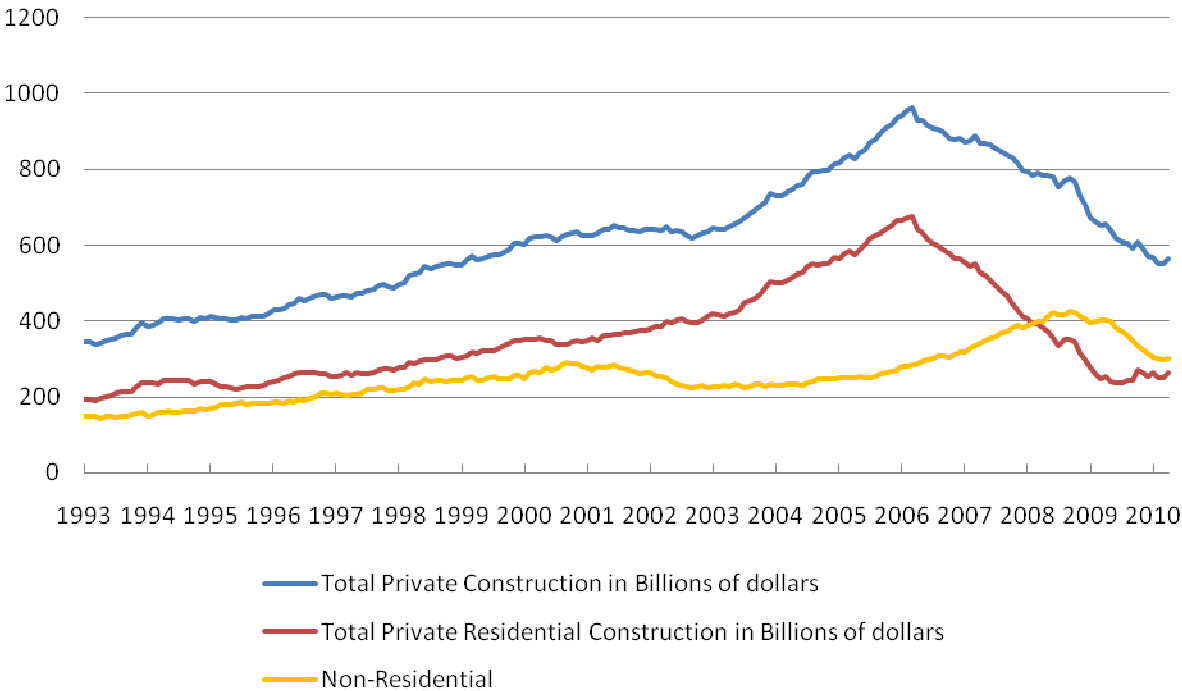
Appendix

Appendix 1: The Normative Valuation Process

Definition of the Problem					
Identification of client/ intended user	Intended use of appraisal	Date of opinion of value	Identification of characteristics of property	Extraordinary assumptions	Hypothetical conditions

Scope of Work

Data Collection and Property Description

Market Area Data
Of region, city, and neighborhood

Subject Property Data
land and improvements, personal property, business assets, etc.

Comparable Property Data
Sales, listings, offerings, vacancies, cost and depreciation, income and expenses, capitalization rates, etc.

Data Analysis

Market Analysis
Demand studies
Supply studies
Marketability studies

Highest and Best Use Analysis
Site as though vacant
Ideal improvement
Property as improved

Land Value Opinion

Application of the Approaches to Value

Cost   Sales Comparison   Income Capitalization

Reconciliation of Value Indications and Final Opinion of Value

Report of Defined Value

Source: Appraisal Institute. The Appraisal of Real Estate 12th Edition, Chicago, IL. Appraisal Institute, 2001, p.51.

Appendix 2: Sales Selection Normative Process

Sales Comparison Approach to Value[12]

1) Research the market for transactional data.

2) Verify that the information is factually accurate and representative of arm's length transactions.

3) Determine relative units of comparison and develop a comparative analysis for each unit.

4) Look for differences between the comparable properties and the subject property and adjust their prices for these differences.

5) Reconcile the various adjusted value indications into a single value approximation for the subject property.

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[12] The Appraisal of Real Estate 12th Edition pg. 422

Appendix 3: Subject Consent Form

Georgia State University
Department of Real Estate
Informed Consent

Title: "An Investigation into the Appraisal Process: The role of decision support tools in valuation judgments"

Principal Investigator: O. Alan Tidwell
Sponsor: Not funded

I.   Purpose :

You are invited to participate in a research study. The purpose of the study is to investigate the real estate valuation decision making process of commercial appraisers. You are invited to participate because you are involved in the commercial real estate appraisal industry. A total of 70 participants will be recruited for this study. Participation will require 45 minutes of your time over one session to be conducted at your desired time in the next 5 weeks, depending on your availability.

II.   Procedures :

You will be asked to provide a value judgment on a tract of industrial land based on the data provided to you. You will be interacting with the investigator to obtain the information for the selected property. The research is being conducted across Georgia over the next 3 months. The time for the participants is estimated at 45 minutes.

III.   Risks:

There will not be any more risks that in a normal day.

IV.   Benefits:

Participation in this study may not benefit you personally. Overall, we hope to gain information about the decision making process of appraisers which may help us to better understand appraiser behavior.

V.   Voluntary Participation and Withdrawal:

Participation in the research is voluntary. You do not have to be in this study. If you decide to be in the study and change your mind, you have the right to drop out at any time. You may skip questions or stop participating at any time. Whatever you decide, you will not lose any benefits to which you are otherwise entitled.

VI.   Confidentiality:

We will keep your records private to the extent allowed by law. Only the investigator will
have access to the information you provide. It will be stored safely in the office of the principal
investigator. Your name and other facts that might point to you will not appear when we present
this study or publish its results. The findings will be summarized and reported in group form.
You will not be identified personally.

VII.   Contact Persons:

Call Alan Tidwell at 205-937-2565, redoatx@langate.gsu.edu if you have questions about this
study. If you have questions or concerns about your rights as a participant in this research study,
you may contact Susan Vogtner in the Office of Research Integrity at 404-413-3513 or
svogtner1@gsu.edu.

VIII.   Copy of Consent Form to Subject:

We will give you a copy of this consent form to keep.
If you are willing to volunteer for this research, please sign below.

_____   _____

Participant   Date

_____   _____

Principal Investigator or Researcher Obtaining Consent   Date

Appendix 4: Research Questionnaire

1. Are you currently employed as an appraiser? _____

2. Approximately what percentage of your work is commercial valuation? _____

3. Approximately what percentage of your work comes from the following sources?

   - _____% Mortgage Lenders

   - _____% Insurance Companies and Pension Funds

   - _____%Government

   - _____% Property owners

   - _____% Other (_____)

4. What state(s) do you perform the majority of your appraisal assignments? _____

5. What is your Gender? _____

6. What is your Age? _____

7. Approximately how many total months have you been appraising property (include all time in the valuation profession trainee to current)? _____

8. Please check the highest level appraisal license obtained.
   Have not yet obtained the Trainee Real Property Appraiser License
   Trainee Real Property Appraiser
   State Registered Real Property
   Licensed Real Property Appraiser
   Certified Residential Real Property Appraiser
   Certified General Real Property Appraiser

9. Please check any professional designation(s) currently held or have held in the past.
   MAI (Member Appraisal Institute)
   SRPA (Senior Real Property Appraiser)
   SREA (Senior Real Estate Appraiser)
   SRA (Senior Residential Appraiser)
   RM (Residential Member)
   IFAS (Senior Designation)

IFAC (Appraiser Counselor Designation)

Other (Please specify, _____)

10. Please check all Level II Appraisal Institute Courses taken. If you already have an MAI designation, please leave blank. The courses are:

   Advanced Income Capitalization

   Advanced Market Analysis and Highest and Best Use or equivalent

   Advanced Sales Comparison and Cost Approaches

   Report Writing and Valuation Analysis

   Advanced Applications

11. What geographical area do you typically cover? (please check one)

   Metro Atlanta

   Georgia

   Regional (Southeast United States)

   National

12. What is your name and contact number_____

13. Are you familiar with the Wilmington, Illinois real estate market? _____

14. Have you had any recent appraisal assignments in the Wilmington, Illinois area? _____

   If no, the remaining question does not apply and you have completed the questionnaire.

   If yes, please give the approximate year of the assignment and indicate the property type

Thank You!

Appendix 5A: Valuation Case, CoStar Control Group

Problem Statement

You have been engaged to estimate the market value of the fee simple interest of a five (5) acre vacant tract of industrial land located in Wilmington, Illinois 60481. The date of the appraisal is the date of the **settlement of the estate, December 31, 2008. Only sales recorded prior to December 31, 2008 should be considered in this analysis.**

A thorough search of the market has revealed no additional comparable transactions occurring prior to or on the date of valuation (December 31, 2008) other than those reflected in the CoStar database. Please use the attached information to conduct an analysis of the market value of the subject property. After completing your analysis, enter your value estimate (point estimate and not a range) in the space provided below.

Purpose of the Appraisal

The purpose of this appraisal is to estimate the fee simple market value of the above identified property, as of **December 31, 2008**, date of estate settlement.

Value Estimate

Estimated Price per Acre $_____

Times No. of Acres (5)   X (5 Acres)

Equals a total value estimate of $_____

Rounded to (if necessary) $_____

Work Sheet

Identification of the Subject Property

Subject photograph

Source: Google Maps

Source: Google Maps

Property Identification

Property Type	Industrial Land
Address/location	Southwest ¼ of Section 21 and the Northwest ¼ of Section 28. Along the north side of Murphy Road between Cavanaugh Road and Interstate 55 in the city of Wilmington, Illinois 60481 (Will County)
Tax ID	Part of Parcel 17-21-300-005
Market	Joliet/Central Will

Land Data

Gross Land Size	5 AC (217,800 SF)
Street Frontage	205 feet on Murphy Rd
Zoning	n/a
Topography	Basically Level
Shape	Regular

**Tax   Assessment
Information**
Percent Improved   70%
Total Value Assessed   n/a
Improved Value Assessed   n/a
Land Value Assessed   n/a
Land Assessed/AC   n/a

Remarks

The subject is located in an area where land has been and is being acquired for an industrial park development. According to a news article published, the industrial park will consist of approximately 1500 acres and is valued around $1 billion at completion.

Subject Property Data

The generally rectangularly shaped subject parcel contains approximately 5.0 acres. Road frontage includes 205 feet along the north side of Murphy road.   Improvements to the site consist of older agricultural and residential buildings similar to those on surrounding land sales in the area. These site improvements, similarly to those on comparable sales in the area, do not contribute to the value of the property as the highest and best use is for an industrial park development.

The site is at road grade and exhibits an overall level topography which is typical of the area.   At the subject property, Murphy Road is a two-lane, asphalt paved roadway and is improved with concrete curbs, gutters, and storm drains. Site ingress and egress are typical for the area.

There are no easements, encroachments or hazardous materials which encumber the site. The subject is not located in a flood hazard zone. Police and fire protection are provided to the subject. Public utilities available include electricity, water, sanitary sewer, and natural gas.

The subject's functional shape, level topography, accessibility, frontage and exposure allow for good physical utility for land uses consistent with those prevalent in the area and would require minimal preparation.

The subject property is under the jurisdiction of Will County. Typical zoning in the area permits office/warehouse/light industrial type development similar to surrounding land uses.

Neighborhood and Market Data

The subject property is located in the city of Wilmington, Illinois. Wilmington is located in the Kankakee River Valley approximately 52 miles south of Chicago and 20 miles south of Joliet. More specifically the subject is located in the Southwest ¼ of Section 21 and the Northwest ¼ of Section 28 along the north side of Murphy Road between Cavanaugh Road and Interstate 55. The subject's immediate neighborhood, as indicated on the attached neighborhood map, is delineated by the following area boundaries:

Kankakee River to the North and East,

Interstate 55 to the south,

the Burlington Northern and Santa Fe, and Union Pacific Rail Lines to the west.

Access to the subject neighborhood is considered good. The major north-south traffic artery in the neighborhood is Interstate 55 which provides direct access to the subject's immediate area at Exit No. 240 (Lorenzo Road).

Lorenzo Road is the primary east-west traffic artery. In addition to I-55 and Lorenzo Road, Interstate 80 is fifteen miles to the north and Interstate 57 is twenty five miles to the east and links the subject neighborhood with major points of interest in the market area.

Development in the subject area is primarily oriented toward light industrial land uses and with some older residential and agricultural uses. The subject neighborhood is estimated to be 20% built-up. Good levels of maintenance and physical appearance typify the subject area.

The primary retail development in the area is located just off I-55 (exit 240) along Lorenzo Road and consists of some retail and service oriented uses along with some retail/warehouse type uses. The land located near the intersection of Lorenzo Road and I-55 (exit 240) and along Lorenzo Road commands the highest value in the neighborhood due to the retail potential. The highest & best use in this well delineated area is retail.

A secondary district is located along Murphy Road (W. Murphy Rd.) and consists primarily of industrial uses mixed with residential and agricultural uses. The highest and best use for this area is industrial type use. It is typical in this district for industrial land sales to include older agricultural buildings or residential dwellings; however these buildings do not contribute to land value and are not representative of the highest and best use at the time of valuation. Typically, the demolition cost of these older agriculture buildings and residential dwellings are offset by the salvage value. Nearby points of interest include several industrial parks, Dresden Cooling Lake, and several nature preserves, along with the city of Joliet.

The neighborhood possesses an above average complement of public, educational, and recreational facilities. Accessibility to medical facilities, neighborhood shopping centers, areas of major employment and other complementary services is typical of similar socio-economic regions.

Economic growth has been consistent and stable in the subject area and is expected to continue in the foreseeable future. A strong employment base and employment opportunities are

present. I-55, I-57, and I-80 provide good access to the surrounding area including the Chicago

CMSA. No adverse conditions are detected in the subject's market area.

Subject Neighborhood Map

CoStar Instructions

In Wilmington, Illinois, CoStar is established as a reliable clearinghouse for commercial property information, and is widely used by practicing commercial appraisers. Moreover, in the subject's market area CoStar COMPS Professional utilizes a census approach to data collection resulting in comprehensive information on comparable sales transactions. **In this case, all sales have been verified and should be considered accurate.**

Temporary access to CoStar COMPS Professional data service is provided for your use via temporary "key" codes provided by the researcher. Please use the CoStar COMPS Professional data service to examine industrial land comparables located in the subject neighborhood (see subject map) in Wilmington, Illinois 60481.

See questions on following pages

Please list the land sales that are the <u>most similar</u> to the subject and used in your appraisal analysis (you may or may not need all of the available space).

	Comparable	Comparable	Comparable	Comparable
Street address				
Size				
Price Per Acre				

	Comparable	Comparable	Comparable	Comparable
Street Address				
Size				
Price Per Acre				

Please rank the comparables <u>previously listed</u> in order from most similar to least similar to the subject (you may or may not need all of the available space).

Ranking 1= most similar	Street Address

Exit Interview

1. Please list the most important factors in determining your value estimate:

2. Please list any information not contained in the case which would have been useful in your valuation analysis:

3. How confident do you feel about your value estimate:

                  Least confident   Most Confident

    (Circle a number) |-------|-------|-------|-------|-------|------|-------|-------|-------|-------|

                               0   1   2   3   4   5   6   7   8   9   10

    In the blanks below, show the upper and lower $/acre where you think there is a 90% probability (almost certain) that the true market value falls within this range.

    $_____/acre $_____/acre $_____/acre
          (Lowest)   (Your estimate)   (Highest)

Appendix 5B: Valuation Case, CoStar Low Anchor Group

Problem Statement

You have been engaged to estimate the market value of the fee simple interest of a five (5) acre vacant tract of industrial land located in Wilmington, Illinois 60481. The date of the appraisal is the date of the **settlement of the estate, December 31, 2008. Only sales recorded prior to December 31, 2008 should be considered in this analysis.**

Enclosed you will find excerpts from an appraisal report recently prepared on the subject by a local MAI. A thorough search of the market has revealed no additional comparable transactions occurring prior to or on the date of valuation (December 31, 2008) other than those reflected in the CoStar database. Please use the attached information to conduct an analysis of the market value of the subject property. After completing your analysis, enter your value estimate (point estimate and not a range) in the space provided below.

Purpose of the Appraisal

The purpose of this appraisal is to estimate the fee simple market value of the above identified property, as of **December 31, 2008**, date of estate settlement.

Value Estimate

Estimated Price per Acre $_____

Times No. of Acres (5)   X (5 Acres)

Equals a total value estimate of $_____

Rounded to (if necessary) $_____

Work Sheet

December 20, 2010

██████████
██████████
██████████

Chicago, Illinois 60601

Atten: ██████████
        Senior Vice President

Re: Appraisal of:
      5.00 Acre Industrial Tract Located on the North side of Murphy Road between
      Interstate 55 and Cavanaugh Road

Dear ██████████ :

At your request, an inspection and appraisal have been completed on the referenced property. The purpose of this appraisal is to estimate the Market Value of the Fee Simple Interest in the property as of December 31, 2008, the date of estate settlement.

The subject property consists of 5.00+/- acres of vacant land and is located in the city limits of Wilmington in Will County, Illinois, 60481. The property is more specifically located along the north side of Murphy Road between Interstate 55 and Cavanaugh Road.

This report has been prepared in conformity with the Uniform Standards of Professional Appraisal Practice (USPAP) and the Standards of Professional Practice of the Appraisal Institute. This appraisal is being reported as a "Summary Appraisal Report" in accordance with Standards Rule 2-2(b) of USPAP.

Enclosed you will find the report which contains the salient data considered and the reasoning leading to our opinion of value. Conditions and Assumptions which may limit or qualify the conclusions are included.

In valuing the subject property, consideration was given to the sales comparison approach to value.

Page 2

At your request, the fee simple market value of the subject property was appraised. Based on the inspection of the property and the investigation and analyses undertaken, the estimated fee simple market value of the subject property, as of December 31, 2008 (date of estate settlement) subject to conditions outlined herein, is indicated as:

THREE HUNDRED SIXTY FIVE THOUSAND DOLLARS
($365,000)

Divided As:

Identification	Acre	$/Acre	Amount
Industrial Land	**5.00**	**$73,000**	**$365,000**

The appraisal report that follows sets forth the identification of the property, comparable data, the results of the investigations and analyses, and the reasoning leading to the conclusions set forth.

Respectfully Submitted,

███████████, MAI
IL State Certified Appraiser
███████████

Attachments
File No. ███████████

Identification of the Subject Property

Subject photograph

Source: Google Maps

Property Identification

Property Type	Industrial Land
Address/location	Southwest ¼ of Section 21 and the Northwest ¼ of Section 28. Along the north side of Murphy Road between Cavanaugh Road and Interstate 55 in the city of Wilmington, Illinois 60481 (Will County)
Tax ID	Part of Parcel 17-21-300-005
Market	Joliet/Central Will

Land Data

Gross Land Size	5 AC (217,800 SF)
Street Frontage	205 feet on Murphy Rd
Zoning	n/a
Topography	Basically Level
Shape	Regular

Tax   Assessment Information

Percent Improved	70%
Total Value Assessed	n/a
Improved Value Assessed	n/a
Land Value Assessed	n/a
Land Assessed/AC	n/a

Remarks

The subject is located in an area where land has been and is being acquired for an industrial park development. According to a news article published, the industrial park will consist of approximately 1500 acres and is valued around $1 billion at completion.

Subject Property Data

The generally rectangularly shaped subject parcel contains approximately 5.0 acres. Road frontage includes 205 feet along the north side of Murphy road.   Improvements to the site consist of older agricultural and residential buildings similar to those on surrounding land sales in the area. These site improvements, similarly to those on comparable sales in the area, do not contribute to the value of the property as the highest and best use is for an industrial park development.

The site is at road grade and exhibits an overall level topography which is typical of the area.   At the subject property, Murphy Road is a two-lane, asphalt paved roadway and is improved with concrete curbs, gutters, and storm drains. Site ingress and egress are typical for the area.

There are no easements, encroachments or hazardous materials which encumber the site. The subject is not located in a flood hazard zone. Police and fire protection are provided to the subject. Public utilities available include electricity, water, sanitary sewer, and natural gas.

The subject's functional shape, level topography, accessibility, frontage and exposure allow for good physical utility for land uses consistent with those prevalent in the area and would require minimal preparation.

The subject property is under the jurisdiction of Will County. Typical zoning in the area permits office/warehouse/light industrial type development similar to surrounding land uses.

Neighborhood and Market Data

The subject property is located in the city of Wilmington, Illinois. Wilmington is located in the Kankakee River Valley approximately 52 miles south of Chicago and 20 miles south of Joliet. More specifically the subject is located in the Southwest ¼ of Section 21 and the Northwest ¼ of Section 28 along the north side of Murphy Road between Cavanaugh Road and Interstate 55. The subject's immediate neighborhood, as indicated on the attached neighborhood map, is delineated by the following area boundaries:

Kankakee River to the North and East,

Interstate 55 to the south,

the Burlington Northern and Santa Fe, and Union Pacific Rail Lines to the west.

Access to the subject neighborhood is considered good. The major north-south traffic artery in the neighborhood is Interstate 55 which provides direct access to the subject's immediate area at Exit No. 240 (Lorenzo Road).

Lorenzo Road is the primary east-west traffic artery. In addition to I-55 and Lorenzo Road, Interstate 80 is fifteen miles to the north and Interstate 57 is twenty five miles to the east and links the subject neighborhood with major points of interest in the market area.

Development in the subject area is primarily oriented toward light industrial land uses and with some older residential and agricultural uses. The subject neighborhood is estimated to be 20% built-up. Good levels of maintenance and physical appearance typify the subject area.

The primary retail development in the area is located just off I-55 (exit 240) along Lorenzo Road and consists of some retail and service oriented uses along with some retail/warehouse type uses. The land located near the intersection of Lorenzo Road and I-55 (exit 240) and along Lorenzo Road commands the highest value in the neighborhood due to the retail potential. The highest & best use in this well delineated area is retail.

A secondary district is located along Murphy Road (W. Murphy Rd.) and consists primarily of industrial uses mixed with residential and agricultural uses. The highest and best use for this area is industrial type use. It is typical in this district for industrial land sales to include older agricultural buildings or residential dwellings; however these buildings do not contribute to land value and are not representative of the highest and best use at the time of valuation. Typically, the demolition cost of these older agriculture buildings and residential dwellings are offset by the salvage value. Nearby points of interest include several industrial parks, Dresden Cooling Lake, and several nature preserves, along with the city of Joliet.

The neighborhood possesses an above average complement of public, educational, and recreational facilities. Accessibility to medical facilities, neighborhood shopping centers, areas of major employment and other complementary services is typical of similar socio-economic regions.

Economic growth has been consistent and stable in the subject area and is expected to continue in the foreseeable future. A strong employment base and employment opportunities are

present. I-55, I-57, and I-80 provide good access to the surrounding area including the Chicago

CMSA. No adverse conditions are detected in the subject's market area.

Subject Neighborhood Map

CoStar Instructions

In Wilmington, Illinois, CoStar is established as a reliable clearinghouse for commercial property information, and is widely used by practicing commercial appraisers. Moreover, in the subject's market area CoStar COMPS Professional utilizes a census approach to data collection resulting in comprehensive information on comparable sales transactions. **In this case, all sales have been verified and should be considered accurate.**

Temporary access to CoStar COMPS Professional data service is provided for your use via temporary "key" codes provided by the researcher. Please use the CoStar COMPS Professional data service to examine industrial land comparables located in the subject neighborhood (see subject map) in Wilmington, Illinois 60481.

See questions on following pages

Please list the land sales that are the <u>most similar</u> to the subject <u>and</u> used in your appraisal analysis (you may or may not need all of the available space).

	Comparable	Comparable	Comparable	Comparable
Street address				
Size				
Price Per Acre				

	Comparable	Comparable	Comparable	Comparable
Street Address				
Size				
Price Per Acre				

Please rank the comparables <u>previously listed</u> in order from most similar to least similar to the subject (you may or may not need all of the available space).

Ranking 1= most similar	Street Address

Exit Interview

1. Please list the most important factors in determining your value estimate:

2. Please list any information not contained in the case which would have been useful in your valuation analysis:

3. How confident do you feel about your value estimate:

                                  Least confident   Most Confident

(Circle a number) |-------|-------|-------|-------|-------|------|-------|-------|-------|-------|

                                   0   1   2   3   4   5   6   7   8   9   10

In the blanks below, show the upper and lower $/acre where you think there is a 90% probability (almost certain) that the true market value falls within this range.

$_____/acre $_____/acre $_____/acre
     (Lowest)   (Your estimate)   (Highest)

Appendix 5C: Valuation Case, CoStar High Anchor Group

Problem Statement

You have been engaged to estimate the market value of the fee simple interest of a five (5) acre vacant tract of industrial land located in Wilmington, Illinois 60481. The date of the appraisal is the date of the **settlement of the estate, December 31, 2008. Only sales recorded prior to December 31, 2008 should be considered in this analysis.**

Enclosed you will find excerpts from an appraisal report recently prepared on the subject by a local MAI. A thorough search of the market has revealed no additional comparable transactions occurring prior to or on the date of valuation (December 31, 2008) other than those reflected in the CoStar database. Please use the attached information to conduct an analysis of the market value of the subject property. After completing your analysis, enter your value estimate (point estimate and not a range) in the space provided below.

Purpose of the Appraisal

The purpose of this appraisal is to estimate the fee simple market value of the above identified property, as of **December 31, 2008**, date of estate settlement.

Value Estimate

Estimated Price per Acre   \$_____

Times No. of Acres (5)   X (5 Acres)

Equals a total value estimate of   \$_____

Rounded to (if necessary)   \$_____

Work Sheet

December 20, 2010

████████
██   ████
████████
████

Chicago, Illinois 60601

Atten: ████████
Senior Vice President

Re: Appraisal of:
5.00 Acre Industrial Tract Located on the North side of Murphy Road between Interstate 55 and Cavanaugh Road

Dear ████████:

At your request, an inspection and appraisal have been completed on the referenced property. The purpose of this appraisal is to estimate the Market Value of the Fee Simple Interest in the property as of December 31, 2008, the date of estate settlement.

The subject property consists of 5.00+/- acres of vacant land and is located in the city limits of Wilmington in Will County, Illinois, 60481. The property is more specifically located along the north side of Murphy Road between Interstate 55 and Cavanaugh Road.

This report has been prepared in conformity with the Uniform Standards of Professional Appraisal Practice (USPAP) and the Standards of Professional Practice of the Appraisal Institute. This appraisal is being reported as a "Summary Appraisal Report" in accordance with Standards Rule 2-2(b) of USPAP.

Enclosed you will find the report which contains the salient data considered and the reasoning leading to our opinion of value. Conditions and Assumptions which may limit or qualify the conclusions are included.

In valuing the subject property, consideration was given to the sales comparison approach to value.

Page 2

At your request, the fee simple market value of the subject property was appraised. Based on the inspection of the property and the investigation and analyses undertaken, the estimated fee simple market value of the subject property, as of December 31, 2008 (date of estate settlement) subject to conditions outlined herein, is indicated as:

FIVE HUNDRED EIGHTY FIVE THOUSAND DOLLARS
($585,000)

Divided As:

Identification	Acre	$/Acre	Amount
Industrial Land	**5.00**	**$117,000**	**$585,000**

The appraisal report that follows sets forth the identification of the property, comparable data, the results of the investigations and analyses, and the reasoning leading to the conclusions set forth.

Respectfully Submitted,

███, MAI
IL State Certified Appraiser
███

Attachments
File No. ███

119

Identification of the Subject Property

Subject photograph

Source: Google Maps

Property Identification

Property Type	Industrial Land
Address/location	Southwest ¼ of Section 21 and the Northwest ¼ of Section 28. Along the north side of Murphy Road between Cavanaugh Road and Interstate 55 in the city of Wilmington, Illinois 60481 (Will County)
Tax ID	Part of Parcel 17-21-300-005
Market	Joliet/Central Will

Land Data

Gross Land Size	5 AC (217,800 SF)
Street Frontage	205 feet on Murphy Rd
Zoning	n/a
Topography	Basically Level
Shape	Regular

Tax   Assessment Information

Percent Improved	70%
Total Value Assessed	n/a
Improved Value Assessed	n/a
Land Value Assessed	n/a
Land Assessed/AC	n/a

Remarks

The subject is located in an area where land has been and is being acquired for an industrial park development. According to a news article published, the industrial park will consist of approximately 1500 acres and is valued around $1 billion at completion.

Subject Property Data

The generally rectangularly shaped subject parcel contains approximately 5.0 acres. Road frontage includes 205 feet along the north side of Murphy road.   Improvements to the site consist of older agricultural and residential buildings similar to those on surrounding land sales in the area. These site improvements, similarly to those on comparable sales in the area, do not contribute to the value of the property as the highest and best use is for an industrial park development.

The site is at road grade and exhibits an overall level topography which is typical of the area.   At the subject property, Murphy Road is a two-lane, asphalt paved roadway and is improved with concrete curbs, gutters, and storm drains. Site ingress and egress are typical for the area.

There are no easements, encroachments or hazardous materials which encumber the site. The subject is not located in a flood hazard zone. Police and fire protection are provided to the subject. Public utilities available include electricity, water, sanitary sewer, and natural gas.

The subject's functional shape, level topography, accessibility, frontage and exposure allow for good physical utility for land uses consistent with those prevalent in the area and would require minimal preparation.

The subject property is under the jurisdiction of Will County. Typical zoning in the area permits office/warehouse/light industrial type development similar to surrounding land uses.

Neighborhood and Market Data

The subject property is located in the city of Wilmington, Illinois. Wilmington is located in the Kankakee River Valley approximately 52 miles south of Chicago and 20 miles south of Joliet. More specifically the subject is located in the Southwest ¼ of Section 21 and the Northwest ¼ of Section 28 along the north side of Murphy Road between Cavanaugh Road and Interstate 55. The subject's immediate neighborhood, as indicated on the attached neighborhood map, is delineated by the following area boundaries:

Kankakee River to the North and East,

Interstate 55 to the south,

the Burlington Northern and Santa Fe, and Union Pacific Rail Lines to the west.

Access to the subject neighborhood is considered good. The major north-south traffic artery in the neighborhood is Interstate 55 which provides direct access to the subject's immediate area at Exit No. 240 (Lorenzo Road).

Lorenzo Road is the primary east-west traffic artery. In addition to I-55 and Lorenzo Road, Interstate 80 is fifteen miles to the north and Interstate 57 is twenty five miles to the east and links the subject neighborhood with major points of interest in the market area.

Development in the subject area is primarily oriented toward light industrial land uses and with some older residential and agricultural uses. The subject neighborhood is estimated to be 20% built-up. Good levels of maintenance and physical appearance typify the subject area.

The primary retail development in the area is located just off I-55 (exit 240) along Lorenzo Road and consists of some retail and service oriented uses along with some retail/warehouse type uses. The land located near the intersection of Lorenzo Road and I-55 (exit 240) and along Lorenzo Road commands the highest value in the neighborhood due to the retail potential. The highest & best use in this well delineated area is retail.

A secondary district is located along Murphy Road (W. Murphy Rd.) and consists primarily of industrial uses mixed with residential and agricultural uses. The highest and best use for this area is industrial type use. It is typical in this district for industrial land sales to include older agricultural buildings or residential dwellings; however these buildings do not contribute to land value and are not representative of the highest and best use at the time of valuation. Typically, the demolition cost of these older agriculture buildings and residential dwellings are offset by the salvage value. Nearby points of interest include several industrial parks, Dresden Cooling Lake, and several nature preserves, along with the city of Joliet.

The neighborhood possesses an above average complement of public, educational, and recreational facilities. Accessibility to medical facilities, neighborhood shopping centers, areas of major employment and other complementary services is typical of similar socio-economic regions.

Economic growth has been consistent and stable in the subject area and is expected to continue in the foreseeable future. A strong employment base and employment opportunities are

present. I-55, I-57, and I-80 provide good access to the surrounding area including the Chicago

CMSA. No adverse conditions are detected in the subject's market area.

Subject Neighborhood Map

CoStar Instructions

In Wilmington, Illinois, CoStar is established as a reliable clearinghouse for commercial property information, and is widely used by practicing commercial appraisers. Moreover, in the subject's market area CoStar COMPS Professional utilizes a census approach to data collection resulting in comprehensive information on comparable sales transactions. **In this case, all sales have been verified and should be considered accurate.**

Temporary access to CoStar COMPS Professional data service is provided for your use via temporary "key" codes provided by the researcher. Please use the CoStar COMPS Professional data service to examine industrial land comparables located in the subject neighborhood (see subject map) in Wilmington, Illinois 60481.

See questions on following pages

Please list the land sales that are the <u>most similar</u> to the subject <u>and</u> used in your appraisal analysis (you may or may not need all of the available space).

	Comparable	Comparable	Comparable	Comparable
Street address				
Size				
Price Per Acre				

	Comparable	Comparable	Comparable	Comparable
Street Address				
Size				
Price Per Acre				

Please rank the comparables <u>previously listed</u> in order from most similar to least similar to the subject (you may or may not need all of the available space).

Ranking 1= most similar	Street Address

Exit Interview

1. Please list the most important factors in determining your value estimate:

2. Please list any information not contained in the case which would have been useful in your valuation analysis:

3. How confident do you feel about your value estimate:

    Least confident   Most Confident

    (Circle a number) |-------|-------|-------|-------|-------|------|-------|-------|-------|-------|
                          0   1   2   3   4   5   6   7   8   9   10

    In the blanks below, show the upper and lower $/acre where you think there is a 90% probability (almost certain) that the true market value falls within this range.

    $_____/acre $_____/acre $_____/acre
        (Lowest)   (Your estimate)   (Highest)

Appendix 5E: Valuation Case, Non-CoStar Control Group

Problem Statement

You have been engaged to estimate the market value of the fee simple interest of a five (5) acre vacant tract of industrial land located in Wilmington, Illinois 60481. The date of the appraisal is the date of the **settlement of the estate, December 31, 2008. Only sales prior to December 31, 2008 should be considered in this analysis.**

A thorough search of the market has revealed no additional comparable transactions occurring prior to or on the date of valuation (December 31, 2008) other than those provided to you. Please use the attached information to conduct an analysis of the market value of the subject property. After completing your analysis, enter your value estimate (point estimate and not a range) in the space provided below.

Purpose of the Appraisal

The purpose of this appraisal is to estimate the fee simple market value of the above identified property, as of **December 31, 2008**, date of estate settlement.

Value Estimate

Estimated Price per Acre $_____

Times No. of Acres (5)   X (5 Acres)

Equals a total value estimate of $_____

Rounded to (if necessary) $_____

Work Sheet

Identification of the Subject Property

Subject photograph

Source: Google Maps

Property Identification

Property Type	Industrial Land
Address/location	Southwest ¼ of Section 21 and the Northwest ¼ of Section 28. Along the north side of Murphy Road between Cavanaugh Road and Interstate 55 in the city of Wilmington, Illinois 60481 (Will County)
Tax ID	Part of Parcel 17-21-300-005
Market	Joliet/Central Will

Land Data

Gross Land Size	5 AC (217,800 SF)
Street Frontage	205 feet on Murphy Rd
Zoning	n/a
Topography	Basically Level
Shape	Regular

Tax   Assessment Information

Percent Improved	70%
Total Value Assessed	n/a
Improved Value Assessed	n/a
Land Value Assessed	n/a
Land Assessed/AC	n/a

Remarks

The subject is located in an area where land has been and is being acquired for an industrial park development. According to a news article published, the industrial park will consist of approximately 1500 acres and is valued around $1 billion at completion.

Subject Property Data

The generally rectangularly shaped subject parcel contains approximately 5.0 acres. Road frontage includes 205 feet along the north side of Murphy road.   Improvements to the site consist of older agricultural and residential buildings similar to those on surrounding land sales in the area. These site improvements, similarly to those on comparable sales in the area, do not contribute to the value of the property as the highest and best use is for an industrial park development.

The site is at road grade and exhibits an overall level topography which is typical of the area.   At the subject property, Murphy Road is a two-lane, asphalt paved roadway and is improved with concrete curbs, gutters, and storm drains. Site ingress and egress are typical for the area.

There are no easements, encroachments or hazardous materials which encumber the site. The subject is not located in a flood hazard zone. Police and fire protection are provided to the subject. Public utilities available include electricity, water, sanitary sewer, and natural gas.

The subject's functional shape, level topography, accessibility, frontage and exposure allow for good physical utility for land uses consistent with those prevalent in the area and would require minimal preparation.

The subject property is under the jurisdiction of Will County. Typical zoning in the area permits office/warehouse/light industrial type development similar to surrounding land uses.

Neighborhood and Market Data

The subject property is located in the city of Wilmington, Illinois. Wilmington is located in the Kankakee River Valley approximately 52 miles south of Chicago and 20 miles south of Joliet. More specifically the subject is located in the Southwest ¼ of Section 21 and the Northwest ¼ of Section 28 along the south side of Murphy Road between Cavanaugh Road and Interstate 55. The subject's immediate neighborhood, as indicated on the attached neighborhood map, is delineated by the following area boundaries:

Kankakee River to the North and East,

Interstate 55 to the south,

the Burlington Northern and Santa Fe, and Union Pacific Rail Lines to the west.

Access to the subject neighborhood is considered good. The major north-south traffic artery in the neighborhood is Interstate 55 which provides direct access to the subject's immediate area at Exit No. 240 (Lorenzo Road).

Lorenzo Road is the primary east-west traffic artery. In addition to I-55 and Lorenzo Road, Interstate 80 is fifteen miles to the north and Interstate 57 is twenty five miles to the east and links the subject neighborhood with major points of interest in the market area.

Development in the subject area is primarily oriented toward light industrial land uses and with some older residential and agricultural uses. The subject neighborhood is estimated to be 20% built-up. Good levels of maintenance and physical appearance typify the subject area.

The primary retail development in the area is located just off I-55 (exit 240) along Lorenzo Road and consists of some retail and service oriented uses along with some retail/warehouse type uses. The land located near the intersection of Lorenzo Road and I-55 (exit 240) and along Lorenzo Road commands the highest value in the neighborhood due to the retail potential. The highest & best use in this well delineated area is retail.

A secondary district is located along Murphy Road (W. Murphy Rd.) and consists primarily of industrial uses mixed with residential and agricultural uses. The highest and best use for this area is industrial type use. It is typical in this district for industrial land sales to include older agricultural buildings or residential dwellings; however these buildings do not contribute to land value and are not representative of the highest and best use at the time of valuation. Typically, the demolition cost of these older agriculture buildings and residential dwellings are offset by the salvage value. Nearby points of interest include several industrial parks, Dresden Cooling Lake, and several nature preserves, along with the city of Joliet.

The neighborhood possesses an above average complement of public, educational, and recreational facilities. Accessibility to medical facilities, neighborhood shopping centers, areas of major employment and other complementary services is typical of similar socio-economic regions.

Economic growth has been consistent and stable in the subject area and is expected to continue in the foreseeable future. A strong employment base and employment opportunities are

present. I-55, I-57, and I-80 provide good access to the surrounding area including the Chicago

CMSA. No adverse conditions are detected in the subject's market area.

Subject Neighborhood Map

Comparable Land Sales Summary Table

Comp ID	Address	Road	Size	Price	Price/Acre	% improved	Street frontage	Zoning	Date of Sale
1	30757	Cavanaugh	7.24	$ 401,888	$ 55,509.39	65%	351	A-1	Oct. 2007
2	24349	Lorenzo	0.6	$ 175,000	$ 291,666.67	n/a	108	A-1	Oct. 2007
3	W. Lorenzo	Lorenzo/Cavanaugh	68.75	$ 1,344,800	$ 19,560.73	0	2400	A-1	June 2005
4	24242	Murphy	5	$ 600,000	$ 120,000.00	83.4	329	A-2	Oct. 2008
5	24438	Murphy	5	$ 350,000	$ 70,000.00	56.5	83	A-1	April 2008
6	24739	Murphy	10	$ 720,000	$ 72,000.00	66.9	1457	A-1	Oct. 2007
7	24840	Murphy	4.04	$ 485,000	$ 120,049.50	58.9	166	A-1	Feb. 2008
8	Murphy	Murphy	124.72	$ 4,457,014	$ 35,736.16	0	303	A-1	Feb. 2008
9	30425	Ragain	3.37	$ 300,000	$ 89,020.77	0	249	E-2	Sep. 2007
Subject	**Murphy**	**Murphy**	**5**			70	205	n/a	n/a

Comparable Location Map

Land Sale No. 1

Source: Google Maps

Property Identification

Property Type	Industrial Land
Address	30757 S Cavanaugh Rd
	Wilmington, IL 60481
Tax ID	17-21-300-007
Market	Chicago, IL
Submarket	Joliet/Central Will

Sale Data

Grantor	Kelly J. Kavanaugh
Grantee	Ridge Logistics Park I, LLC
Buyer Type	Developer/Owner
Sale Date	October 18, 2007
Verification	Public Deed
Property Rights	Fee Simple
Proposed Use	Industrial Park (Ridge Logistics Park)
Sale Conditions	Assemblage
Sale Type	Investment
Sale Price	$401,888
Price/Acre Land Gross	$55,509.39

Land Data

Gross Land Size	7.24 AC (315,374 SF)
Street Frontage	351 feet on Cavanaugh Rd
Zoning	A-1
Topography	Basically Level
Shape	Regular
Improvements	Ag. Buildings

Tax Assessment Information

Percent Improved	65%
Total Value Assessed	$40,972
Improved Value Assessed	$26,637
Land Value Assessed	$14,335
Land Assessed/AC	$1,979

Remarks

According to the news article published on this deal, this is part of an 18 million sf industrial park. The buyer has been spending the last three years assembling the parcels from several owners. The park will consist of approximately 1500 acres and is valued around $1 billion at completion. At time of publication of this report, the seller was unable to be contacted as their only telephone number in public record has been disconnected. Buyer was unable to be contacted or would not provide any details on the transaction. County planning office was contacted but is unable to provide any information regarding issued permits and approvals for the parcels in this park, as they require information requests be submitted in writing.

Land Sale No. 2

Source: Google Maps

Property Identification

Property Type   Industrial Land
Address   24349 Lorenzo Road
                           Wilmington, IL 60481
Tax ID   17-16-200-004
Market   Chicago, IL
Submarket   Joliet/Central Will

Sale Data

Grantor   Steven E & Tammy S Pozzi
Grantee   Ridge Logistics Park I, LLC
Buyer Type   Developer/Owner
Sale Date   October 15, 2007
Verification   Public Deed
Property Rights   Fee Simple
Proposed Use   Industrial Park (Ridge Logistics Park)
Sale Conditions   Assemblage
Sale Type   Investment

Sale Price $175,000
Price/Acre Land Gross $291,666.67

Land Data

Gross Land Size	0.60 AC (26,136 SF)
Street Frontage	108 feet on Lorenzo Rd
Zoning	A-1
Topography	Basically Level
Shape	Regular
Improvements	n/a

Tax Assessment Information

Percent Improved	n/a
Total Value Assessed	$10,338
Improved Value Assessed	$0
Land Value Assessed	$10,338
Land Assessed/AC	$17,230

Remarks

According to the news article published on this deal, this is part of an 18 million sf industrial park. The buyer has been spending the last three years assembling the parcels from several owners. The park will consist of approximately 1500 acres and is valued around $1 billion at completion. At time of publication of this report, the seller was unable to be contacted as their only telephone number in public record has been disconnected. Buyer was unable to be contacted or would not provide any details on the transaction. County planning office was contacted but is unable to provide any information regarding issued permits and approvals for the parcels in this park, as they require information requests be submitted in writing.

Land Sale No. 3

Source: Google Maps

Property Identification

Property Type	Industrial Land
Address	W. Lorenzo Road
	Wilmington, IL 60481
Tax ID	17-17-200-013
Market	Chicago, IL
Submarket	Joliet/Central Will

Sale Data

Grantor	Ned P & Diane M Robertson
Grantee	Ridge Logistics Park I, LLC
Buyer Type	Developer/Owner
Sale Date	June 07, 2005
Verification	Public Deed
Property Rights	Fee Simple
Proposed Use	Industrial Park (Ridge Logistics Park)
Sale Conditions	Assemblage
Sale Type	Investment
Sale Price	$1,344,800
Price/Acre Land Gross	$19,560.73

Land Data

Gross Land Size	68.75 AC (2,994,750 SF)
Street Frontage	416 feet on Lorenzo Rd and 1,984 feet on Kavanaugh Rd
Zoning	A-1
Topography	Basically Level
Shape	Regular
Improvements	Raw Land

Tax Assessment Information

Percent Improved	0%
Total Value Assessed	$9,059
Improved Value Assessed	$0
Land Value Assessed	$9,059
Land Assessed/AC	$131

Remarks

According to the news article published on this deal, this is part of an 18 million sf industrial park. The buyer has been spending the last three years assembling the parcels from several owners. The park will consist of approximately 1500 acres and is valued around $1 billion at completion. At time of publication of this report, the seller was unable to be contacted as their only telephone number in public record has been disconnected. Buyer was unable to be contacted or would not provide any details on the transaction. County planning office was contacted but is unable to provide any information regarding issued permits and approvals for the parcels in this park, as they require information requests be submitted in writing.

Land Sale No.4

Source: Google Maps

Property Identification

Property Type	Industrial Land
Address	24242 Murphy Rd
	Wilmington, IL 60481
Tax ID	17-21-200-005
Market	Chicago, IL
Submarket	Joliet/Central Will

Sale Data

Grantor	Jeffrey L & Barbara Lardi
Grantee	Ridge Logistics Park I, LLC
Buyer Type	Developer/Owner
Sale Date	October 01, 2008
Verification	Public Deed
Property Rights	Fee Simple
Proposed Use	Industrial Park (Ridge Logistics Park)
Sale Conditions	Assemblage
Sale Type	Investment

Sale Price	$600,000
Price/Acre Land Gross	$120,000

Land Data

Gross Land Size	5 AC (217,800 SF)
Street Frontage	329 feet on Murphy Rd
Zoning	A-2
Topography	Basically Level
Shape	Regular
Improvements	Ag. Buildings

Tax Assessment Information

Percent Improved	83.4%
Total Value Assessed	$89,085
Improved Value Assessed	$74,316
Land Value Assessed	$14,769
Land Assessed/AC	$2,953

Remarks

According to the news article published on this deal, this is part of an 18 million sf industrial park. The buyer has been spending the last three years assembling the parcels from several owners. The park will consist of approximately 1500 acres and is valued around $1 billion at completion. At time of publication of this report, the seller was unable to be contacted as their only telephone number in public record has been disconnected. Buyer was unable to be contacted or would not provide any details on the transaction. County planning office was contacted but is unable to provide any information regarding issued permits and approvals for the parcels in this park, as they require information requests be submitted in writing.

Land Sale No.5

Source: Google Maps

Property Identification

Property Type   Industrial Land
Address   24438 Murphy Rd
      Wilmington, IL 60481
Tax ID   17-21-100-018
Market   Chicago, IL
Submarket   Joliet/Central Will

Sale Data

Grantor   Warren G & Phillis L Campbell
Grantee   Ridge Logistics Park I, LLC
Buyer Type   Developer/Owner
Sale Date   April 02, 2008
Verification   Public Deed
Property Rights   Fee Simple
Proposed Use   Industrial Park (Ridge Logistics Park)
Sale Conditions   Assemblage
Sale Type   Investment

Sale Price $350,000
Price/Acre Land Gross $70,000

Land Data

Gross Land Size	5 AC (217,800 SF)
Street Frontage	83 feet on Murphy Rd
Zoning	A-2
Topography	Basically Level
Shape	Regular
Improvements	Ag. Buildings

Tax Assessment Information

Percent Improved	56.5%
Total Value Assessed	$29,127
Improved Value Assessed	$16,464
Land Value Assessed	$12,663
Land Assessed/AC	$2,532

Remarks

According to the news article published on this deal, this is part of an 18 million sf industrial park. The buyer has been spending the last three years assembling the parcels from several owners. The park will consist of approximately 1500 acres and is valued around $1 billion at completion. At time of publication of this report, the seller was unable to be contacted as their only telephone number in public record has been disconnected. Buyer was unable to be contacted or would not provide any details on the transaction. County planning office was contacted but is unable to provide any information regarding issued permits and approvals for the parcels in this park, as they require information requests be submitted in writing.

Land Sale No.6

Source: Google Maps

Property Identification

Property Type	Industrial Land
Address	24739 Murphy Rd
	Wilmington, IL 60481
Tax ID	17-21-300-027
Market	Chicago, IL
Submarket	Joliet/Central Will

Sale Data

Grantor	William H & Lisa M Taylor
Grantee	Ridge Logistics Park I, LLC
Buyer Type	Developer/Owner
Sale Date	October 22, 2007
Verification	Public Deed
Property Rights	Fee Simple
Proposed Use	Industrial Park (Ridge Logistics Park)
Sale Conditions	Assemblage
Sale Type	Investment
Sale Price	$720,000
Price/Acre Land Gross	$72,000

Land Data

Gross Land Size	10 AC (435,600 SF)
Street Frontage	1,093 feet on Murphy Rd & 364 feet on Cavanaugh Rd
Zoning	A-1
Topography	Basically Level
Shape	Regular
Improvements	Farm Buildings

Tax   Assessment Information

Percent Improved	66.9%
Total Value Assessed	$167,711
Improved Value Assessed	$112,215
Land Value Assessed	$55,496
Land Assessed/AC	$5,549

Remarks

According to the news article published on this deal, this is part of an 18 million sf industrial park. The buyer has been spending the last three years assembling the parcels from several owners. The park will consist of approximately 1500 acres and is valued around $1 billion at completion. At time of publication of this report, the seller was unable to be contacted as their only telephone number in public record has been disconnected. Buyer was unable to be contacted or would not provide any details on the transaction. County planning office was contacted but is unable to provide any information regarding issued permits and approvals for the parcels in this park, as they require information requests be submitted in writing.

Land Sale No.7

Source: Google Maps

Property Identification

Property Type   Industrial Land
Address   24840 Murphy Rd
Wilmington, IL 60481
Tax ID   17-20-201-002
Market   Chicago, IL
Submarket   Joliet/Central Will

Sale Data

Grantor   Carlotta Marchese
Grantee   Ridge Logistics Park I, LLC
Buyer Type   Developer/Owner
Sale Date   February 27, 2008
Verification   Public Deed
Property Rights   Fee Simple
Proposed Use   Industrial Park (Ridge Logistics Park)
Sale Conditions   Assemblage
Sale Type   Investment

Sale Price $485,000
Price/Acre Land Gross $120,049.50

Land Data

Gross Land Size	4.04 AC (175,982 SF)
Street Frontage	166 feet on Murphy Rd
Zoning	A-1
Topography	Basically Level
Shape	Regular
Improvements	Ag. Buildings

Tax Assessment Information

Percent Improved	58.9%
Total Value Assessed	$34,689
Improved Value Assessed	$20,416
Land Value Assessed	$14,273
Land Assessed/AC	$3,532

Remarks

According to the news article published on this deal, this is part of an 18 million sf industrial park. The buyer has been spending the last three years assembling the parcels from several owners. The park will consist of approximately 1500 acres and is valued around $1 billion at completion. At time of publication of this report, the seller was unable to be contacted as their only telephone number in public record has been disconnected. Buyer was unable to be contacted or would not provide any details on the transaction. County planning office was contacted but is unable to provide any information regarding issued permits and approvals for the parcels in this park, as they require information requests be submitted in writing.

Land Sale No.8

Source: Google Maps

Property Identification

Property Type   Industrial Land
Address   W. Murphy Rd
                           Wilmington, IL 60481
Tax ID   17-28-100-005
Market   Chicago, IL
Submarket   Joliet/Central Will

Sale Data

Grantor   Dobi Investments LLC
Grantee   Ridge Logistics Park I, LLC
Buyer Type   Developer/Owner
Sale Date   February 13, 2008
Verification   Public Deed
Property Rights   Fee Simple
Proposed Use   Industrial Park (Ridge Logistics Park)
Sale Conditions   Assemblage
Sale Type   Investment

Sale Price $4,457,014
Price/Acre Land Gross $35,736.16

Land Data

Gross Land Size	124.72 AC (5,432,803 SF)
Street Frontage	303feet on Murphy Rd
Zoning	A-1
Topography	Basically Level
Shape	Regular
Improvements	Raw Land

Tax   Assessment Information

Percent Improved	0%
Total Value Assessed	$5,021
Improved Value Assessed	$0
Land Value Assessed	$5,021
Land Assessed/AC	$40

Remarks

According to the news article published on this deal, this is part of an 18 million sf industrial park. The buyer has been spending the last three years assembling the parcels from several owners. The park will consist of approximately 1500 acres and is valued around $1 billion at completion. At time of publication of this report, the seller was unable to be contacted as their only telephone number in public record has been disconnected. Buyer was unable to be contacted or would not provide any details on the transaction. County planning office was contacted but is unable to provide any information regarding issued permits and approvals for the parcels in this park, as they require information requests be submitted in writing.

Land Sale No.9

Source: Google Maps

Property Identification

Property Type   Industrial Land
Address   30425 Ragain Ln
      Wilmington, IL 60481
Tax ID   17-21-100-036
Market   Chicago, IL
Submarket   Joliet/Central Will

Sale Data

Grantor   Conrad & Beverly Stanley
Grantee   Ridge Logistics Park I, LLC
Buyer Type   Developer/Owner
Sale Date   September 17, 2007
Verification   Public Deed
Property Rights   Fee Simple
Proposed Use   Industrial Park (Ridge Logistics Park)
Sale Conditions   Assemblage
Sale Type   Investment

Sale Price $300,000
Price/Acre Land Gross $89,020.77

Land Data

Gross Land Size	3.37 AC (146,797 SF)
Street Frontage	249 feet on Ragain Ln
Zoning	E-2
Topography	Basically Level
Shape	Regular
Improvements	Raw Land

Tax   Assessment Information

Percent Improved	0%
Total Value Assessed	$9,514
Improved Value Assessed	$0
Land Value Assessed	$9,514
Land Assessed/AC	$2,823

Remarks

According to the news article published on this deal, this is part of an 18 million sf industrial park. The buyer has been spending the last three years assembling the parcels from several owners. The park will consist of approximately 1500 acres and is valued around $1 billion at completion. At time of publication of this report, the seller was unable to be contacted as their only telephone number in public record has been disconnected. Buyer was unable to be contacted or would not provide any details on the transaction. County planning office was contacted but is unable to provide any information regarding issued permits and approvals for the parcels in this park, as they require information requests be submitted in writing.

Please list the land sales that are the <u>most similar</u> to the subject and used in your appraisal analysis (you may or may not need all of the available space).

	Comparable	Comparable	Comparable	Comparable
Street address				
Price				
Size				
Price Per Acre				

	Comparable	Comparable	Comparable	Comparable
Street Address				
Price				
Size				
Price Per Acre				

Please rank the comparables <u>previously listed</u> in order from most similar to least similar to the subject (you may or may not need all of the available space).

Ranking 1= most similar	Street Address

Exit Interview

1. Please list the most important factors in determining your value estimate:

2. Please list any information not contained in the case which would have been useful in your valuation analysis:

3. How confident do you feel about your value estimate:

                     Least confident   Most Confident

(Circle a number) |-------|-------|-------|-------|-------|------|-------|-------|-------|-------|

                      0   1   2   3   4   5   6   7   8   9   10

In the blanks below, show the upper and lower $/acre where you think there is a 90% probability (almost certain) that the true market value falls within this range.

$_____/acre $_____/acre $_____/acre
     (Lowest)   (Your estimate)   (Highest)

Appendix 5F: Valuation Case, Non-CoStar, Low Anchor Group

Problem Statement

You have been engaged to estimate the market value of the fee simple interest of a five (5) acre vacant tract of industrial land located in Wilmington, Illinois 60481. The date of the appraisal is the date of the **settlement of the estate, December 31, 2008. Only sales prior to December 31, 2008 should be considered in this analysis.**

Enclosed you will find excerpts from an appraisal report recently prepared on the subject by a local MAI. A thorough search of the market has revealed no additional comparable transactions occurring prior to or on the date of valuation (December 31, 2008) other than those provided to you. Please use the attached information to conduct an analysis of the market value of the subject property. After completing your analysis, enter your value estimate (point estimate and not a range) in the space provided below.

Purpose of the Appraisal

The purpose of this appraisal is to estimate the fee simple market value of the above identified property, as of **December 31, 2008**, date of estate settlement.

Value Estimate

Estimated Price per Acre $_____

Times No. of Acres (5)   X (5 Acres)

Equals a total value estimate of $_____

Rounded to (if necessary) $_____

Work Sheet

December 20, 2010

█████████████████████
█████████████████████
█████████████████████

Chicago, Illinois 60601

Atten: ███████████
        Senior Vice President

Re: Appraisal of:
        5.00 Acre Industrial Tract Located on the North side of Murphy Road between Interstate
        55 and Cavanaugh Road

Dear ██████████ :

At your request, an inspection and appraisal have been completed on the referenced property.
The purpose of this appraisal is to estimate the Market Value of the Fee Simple Interest in the
property as of December 31, 2008, the date of estate settlement.

The subject property consists of 5.00+/- acres of vacant land and is located in the city limits of
Wilmington in Will County, Illinois, 60481. The property is more specifically located along the
north side of Murphy Road between Interstate 55 and Cavanaugh Road.

This report has been prepared in conformity with the Uniform Standards of Professional
Appraisal Practice (USPAP) and the Standards of Professional Practice of the Appraisal Institute.
This appraisal is being reported as a "Summary Appraisal Report" in accordance with Standards
Rule 2-2(b) of USPAP.

Enclosed you will find the report which contains the salient data considered and the reasoning
leading to our opinion of value. Conditions and Assumptions which may limit or qualify the
conclusions are included.

In valuing the subject property, consideration was given to the sales comparison approach to
value.

Page 2

At your request, the fee simple market value of the subject property was appraised. Based on the inspection of the property and the investigation and analyses undertaken, the estimated fee simple market value of the subject property, as of December 31, 2008 (date of estate settlement) subject to conditions outlined herein, is indicated as:

THREE HUNDRED SIXTY FIVE THOUSAND DOLLARS
($365,000)

Divided As:

Identification	Acre	$/Acre	Amount
Industrial Land	**5.00**	**$73,000**	**$365,000**

The appraisal report that follows sets forth the identification of the property, comparable data, the results of the investigations and analyses, and the reasoning leading to the conclusions set forth.

Respectfully Submitted,

██████████, MAI
IL State Certified Appraiser
████████

Attachments
File No. ████████

Identification of the Subject Property

Subject photograph

Source: Google Maps

Property Identification

Property Type	Industrial Land
Address/location	Southwest ¼ of Section 21 and the Northwest ¼ of Section 28. Along the north side of Murphy Road between Cavanaugh Road and Interstate 55 in the city of Wilmington, Illinois 60481 (Will County)
Tax ID	Part of Parcel 17-21-300-005
Market	Joliet/Central Will

Land Data

Gross Land Size	5 AC (217,800 SF)
Street Frontage	205 feet on Murphy Rd
Zoning	n/a
Topography	Basically Level
Shape	Regular

Tax   Assessment Information

Percent Improved	70%
Total Value Assessed	n/a
Improved Value Assessed	n/a
Land Value Assessed	n/a
Land Assessed/AC	n/a

Remarks

The subject is located in an area where land has been and is being acquired for an industrial park development. According to a news article published, the industrial park will consist of approximately 1500 acres and is valued around $1 billion at completion.

Subject Property Data

The generally rectangularly shaped subject parcel contains approximately 5.0 acres. Road frontage includes 205 feet along the north side of Murphy road. Improvements to the site consist of older agricultural and residential buildings similar to those on surrounding land sales in the area. These site improvements, similarly to those on comparable sales in the area, do not contribute to the value of the property as the highest and best use is for an industrial park development.

The site is at road grade and exhibits an overall level topography which is typical of the area. At the subject property, Murphy Road is a two-lane, asphalt paved roadway and is improved with concrete curbs, gutters, and storm drains. Site ingress and egress are typical for the area.

There are no easements, encroachments or hazardous materials which encumber the site. The subject is not located in a flood hazard zone. Police and fire protection are provided to the subject. Public utilities available include electricity, water, sanitary sewer, and natural gas.

The subject's functional shape, level topography, accessibility, frontage and exposure allow for good physical utility for land uses consistent with those prevalent in the area and would require minimal preparation.

The subject property is under the jurisdiction of Will County. Typical zoning in the area permits office/warehouse/light industrial type development similar to surrounding land uses.

Neighborhood and Market Data

The subject property is located in the city of Wilmington, Illinois. Wilmington is located in the Kankakee River Valley approximately 52 miles south of Chicago and 20 miles south of Joliet. More specifically the subject is located in the Southwest ¼ of Section 21 and the Northwest ¼ of Section 28 along the south side of Murphy Road between Cavanaugh Road and Interstate 55. The subject's immediate neighborhood, as indicated on the attached neighborhood map, is delineated by the following area boundaries:

Kankakee River to the North and East,

Interstate 55 to the south,

the Burlington Northern and Santa Fe, and Union Pacific Rail Lines to the west.

Access to the subject neighborhood is considered good. The major north-south traffic artery in the neighborhood is Interstate 55 which provides direct access to the subject's immediate area at Exit No. 240 (Lorenzo Road).

Lorenzo Road is the primary east-west traffic artery. In addition to I-55 and Lorenzo Road, Interstate 80 is fifteen miles to the north and Interstate 57 is twenty five miles to the east and links the subject neighborhood with major points of interest in the market area.

Development in the subject area is primarily oriented toward light industrial land uses and with some older residential and agricultural uses. The subject neighborhood is estimated to be 20% built-up. Good levels of maintenance and physical appearance typify the subject area.
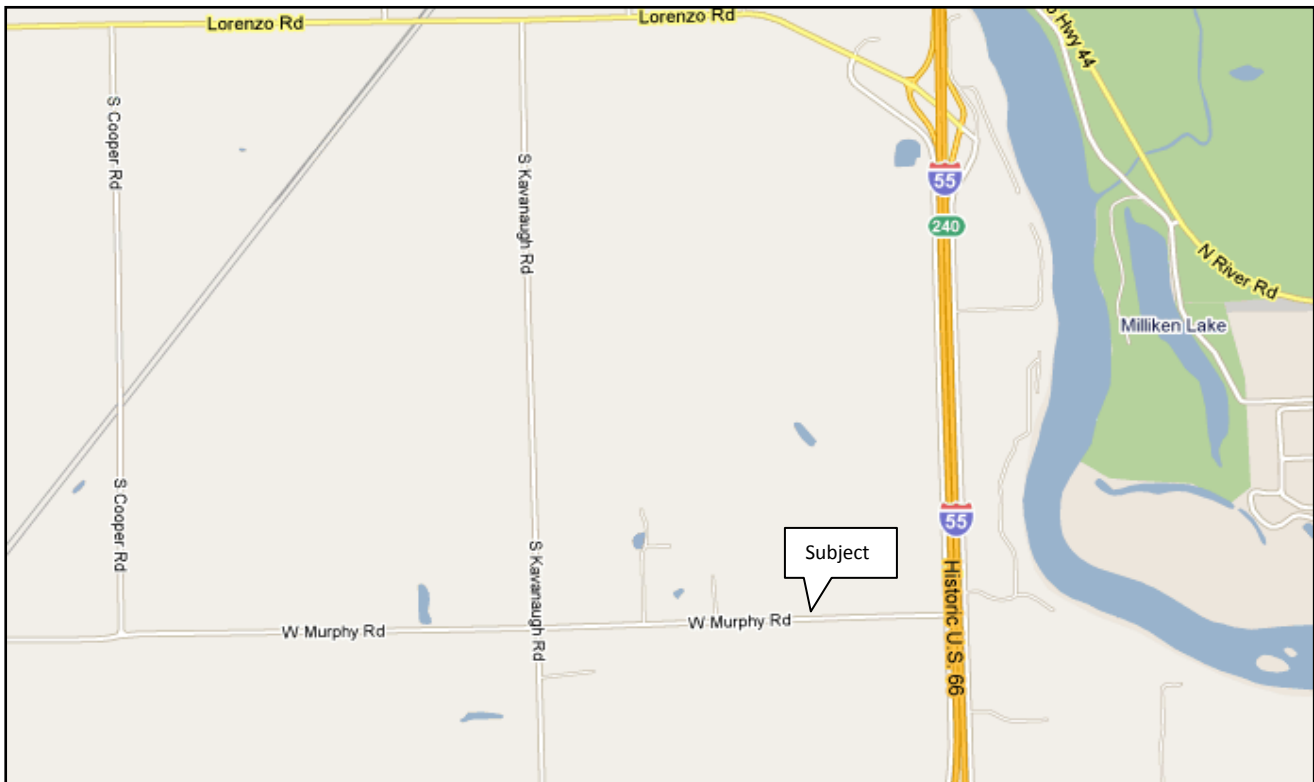
The primary retail development in the area is located just off I-55 (exit 240) along Lorenzo Road and consists of some retail and service oriented uses along with some retail/warehouse type uses. The land located near the intersection of Lorenzo Road and I-55 (exit 240) and along Lorenzo Road commands the highest value in the neighborhood due to the retail potential. The highest & best use in this well delineated area is retail.

A secondary district is located along Murphy Road (W. Murphy Rd.) and consists primarily of industrial uses mixed with residential and agricultural uses. The highest and best use for this area is industrial type use. It is typical in this district for industrial land sales to include older agricultural buildings or residential dwellings; however these buildings do not contribute to land value and are not representative of the highest and best use at the time of valuation. Typically, the demolition cost of these older agriculture buildings and residential dwellings are offset by the salvage value. Nearby points of interest include several industrial parks, Dresden Cooling Lake, and several nature preserves, along with the city of Joliet.

The neighborhood possesses an above average complement of public, educational, and recreational facilities. Accessibility to medical facilities, neighborhood shopping centers, areas of major employment and other complementary services is typical of similar socio-economic regions.

Economic growth has been consistent and stable in the subject area and is expected to continue in the foreseeable future. A strong employment base and employment opportunities are

present. I-55, I-57, and I-80 provide good access to the surrounding area including the Chicago

CMSA. No adverse conditions are detected in the subject's market area.

Subject Neighborhood Map

Note: Comparable Land Sales information remains the same as presented previously in Appendix 3E, and is not included in Appendix 3F.

Please list the land sales that are the <u>most similar</u> to the subject and used in your appraisal analysis (you may or may not need all of the available space).

	Comparable	Comparable	Comparable	Comparable
Street address				
Price				
Size				
Price Per Acre				

	Comparable	Comparable	Comparable	Comparable
Street Address				
Price				
Size				
Price Per Acre				

Please rank the comparables <u>previously listed</u> in order from most similar to least similar to the subject (you may or may not need all of the available space).

Ranking 1= most similar	Street Address

Exit Interview

1. Please list the most important factors in determining your value estimate:

2. Please list any information not contained in the case which would have been useful in your valuation analysis:

3. How confident do you feel about your value estimate:

                    Least confident   Most Confident

(Circle a number) |-------|-------|-------|-------|-------|------|-------|-------|-------|-------|

                        0   1   2   3   4   5   6   7   8   9   10

In the blanks below, show the upper and lower $/acre where you think there is a 90% probability (almost certain) that the true market value falls within this range.

$_____/acre $_____/acre $_____/acre
    (Lowest)   (Your estimate)   (Highest)

Appendix 5G: Valuation Case, Non-CoStar High Anchor Group

Problem Statement

You have been engaged to estimate the market value of the fee simple interest of a five (5) acre vacant tract of industrial land located in Wilmington, Illinois 60481. The date of the appraisal is the date of the **settlement of the estate, December 31, 2008. Only sales prior to December 31, 2008 should be considered in this analysis.**

Enclosed you will find excerpts from an appraisal report recently prepared on the subject by a local MAI. A thorough search of the market has revealed no additional comparable transactions occurring prior to or on the date of valuation (December 31, 2008) other than those provided to you. Please use the attached information to conduct an analysis of the market value of the subject property. After completing your analysis, enter your value estimate (point estimate and not a range) in the space provided below.

Purpose of the Appraisal

The purpose of this appraisal is to estimate the fee simple market value of the above identified property, as of **December 31, 2008**, date of estate settlement.

Value Estimate

Estimated Price per Acre $_____

Times No. of Acres (5)   X (5 Acres)

Equals a total value estimate of $_____

Rounded to (if necessary) $_____

Work Sheet

December 20, 2010

████████████
████████████

Chicago, Illinois 60601

Atten: ████████████
        Senior Vice President

Re: Appraisal of:
       5.00 Acre Industrial Tract Located on the North side of Murphy Road between Interstate
       55 and Cavanaugh Road

Dear ████████████ :

At your request, an inspection and appraisal have been completed on the referenced property. The purpose of this appraisal is to estimate the Market Value of the Fee Simple Interest in the property as of December 31, 2008, the date of estate settlement.

The subject property consists of 5.00+/- acres of vacant land and is located in the city limits of Wilmington in Will County, Illinois, 60481. The property is more specifically located along the north side of Murphy Road between Interstate 55 and Cavanaugh Road.

This report has been prepared in conformity with the Uniform Standards of Professional Appraisal Practice (USPAP) and the Standards of Professional Practice of the Appraisal Institute. This appraisal is being reported as a "Summary Appraisal Report" in accordance with Standards Rule 2-2(b) of USPAP.

Enclosed you will find the report which contains the salient data considered and the reasoning leading to our opinion of value. Conditions and Assumptions which may limit or qualify the conclusions are included.

In valuing the subject property, consideration was given to the sales comparison approach to value.

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Page 2

At your request, the fee simple market value of the subject property was appraised. Based on the inspection of the property and the investigation and analyses undertaken, the estimated fee simple market value of the subject property, as of December 31, 2008 (date of estate settlement) subject to conditions outlined herein, is indicated as:

FIVE HUNDRED EIGHTY FIVE THOUSAND DOLLARS
($585,000)

Divided As:

Identification	Acre	$/Acre	Amount
Industrial Land	**5.00**	**$117,000**	**$585,000**

The appraisal report that follows sets forth the identification of the property, comparable data, the results of the investigations and analyses, and the reasoning leading to the conclusions set forth.
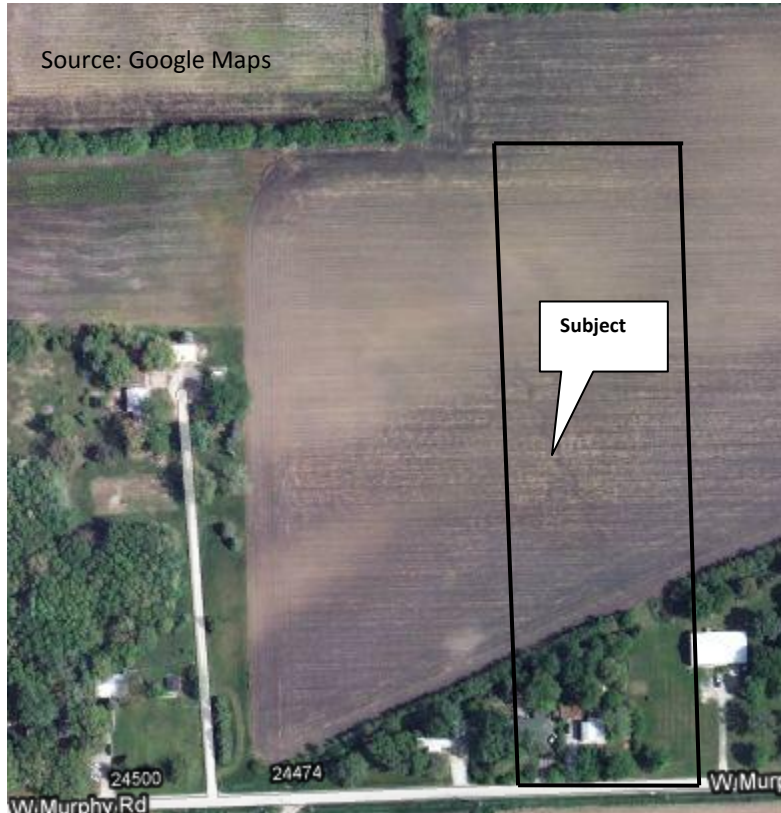
Respectfully Submitted,

████████████, MAI
IL State Certified Appraiser
███████████

Attachments
File No. ███████████

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Identification of the Subject Property

Subject photograph

Source: Google Maps

Property Identification

Property Type	Industrial Land
Address/location	Southwest ¼ of Section 21 and the Northwest ¼ of Section 28. Along the north side of Murphy Road between Cavanaugh Road and Interstate 55 in the city of Wilmington, Illinois 60481 (Will County)
Tax ID	Part of Parcel 17-21-300-005
Market	Joliet/Central Will

Land Data

Gross Land Size	5 AC (217,800 SF)
Street Frontage	205 feet on Murphy Rd
Zoning	n/a
Topography	Basically Level
Shape	Regular

Tax   Assessment Information

Percent Improved	70%
Total Value Assessed	n/a
Improved Value Assessed	n/a
Land Value Assessed	n/a
Land Assessed/AC	n/a

Remarks

The subject is located in an area where land has been and is being acquired for an industrial park development. According to a news article published, the industrial park will consist of approximately 1500 acres and is valued around $1 billion at completion.

Subject Property Data

The generally rectangularly shaped subject parcel contains approximately 5.0 acres. Road frontage includes 205 feet along the north side of Murphy road.   Improvements to the site consist of older agricultural and residential buildings similar to those on surrounding land sales in the area. These site improvements, similarly to those on comparable sales in the area, do not contribute to the value of the property as the highest and best use is for an industrial park development.

The site is at road grade and exhibits an overall level topography which is typical of the area.   At the subject property, Murphy Road is a two-lane, asphalt paved roadway and is improved with concrete curbs, gutters, and storm drains. Site ingress and egress are typical for the area.

There are no easements, encroachments or hazardous materials which encumber the site. The subject is not located in a flood hazard zone. Police and fire protection are provided to the subject. Public utilities available include electricity, water, sanitary sewer, and natural gas.

The subject's functional shape, level topography, accessibility, frontage and exposure allow for good physical utility for land uses consistent with those prevalent in the area and would require minimal preparation.

The subject property is under the jurisdiction of Will County. Typical zoning in the area permits office/warehouse/light industrial type development similar to surrounding land uses.

Neighborhood and Market Data

The subject property is located in the city of Wilmington, Illinois. Wilmington is located in the Kankakee River Valley approximately 52 miles south of Chicago and 20 miles south of Joliet. More specifically the subject is located in the Southwest ¼ of Section 21 and the Northwest ¼ of Section 28 along the south side of Murphy Road between Cavanaugh Road and Interstate 55. The subject's immediate neighborhood, as indicated on the attached neighborhood map, is delineated by the following area boundaries:

Kankakee River to the North and East,

Interstate 55 to the south,

the Burlington Northern and Santa Fe, and Union Pacific Rail Lines to the west.

Access to the subject neighborhood is considered good. The major north-south traffic artery in the neighborhood is Interstate 55 which provides direct access to the subject's immediate area at Exit No. 240 (Lorenzo Road).

Lorenzo Road is the primary east-west traffic artery. In addition to I-55 and Lorenzo Road, Interstate 80 is fifteen miles to the north and Interstate 57 is twenty five miles to the east and links the subject neighborhood with major points of interest in the market area.

Development in the subject area is primarily oriented toward light industrial land uses and with some older residential and agricultural uses. The subject neighborhood is estimated to be 20% built-up. Good levels of maintenance and physical appearance typify the subject area.
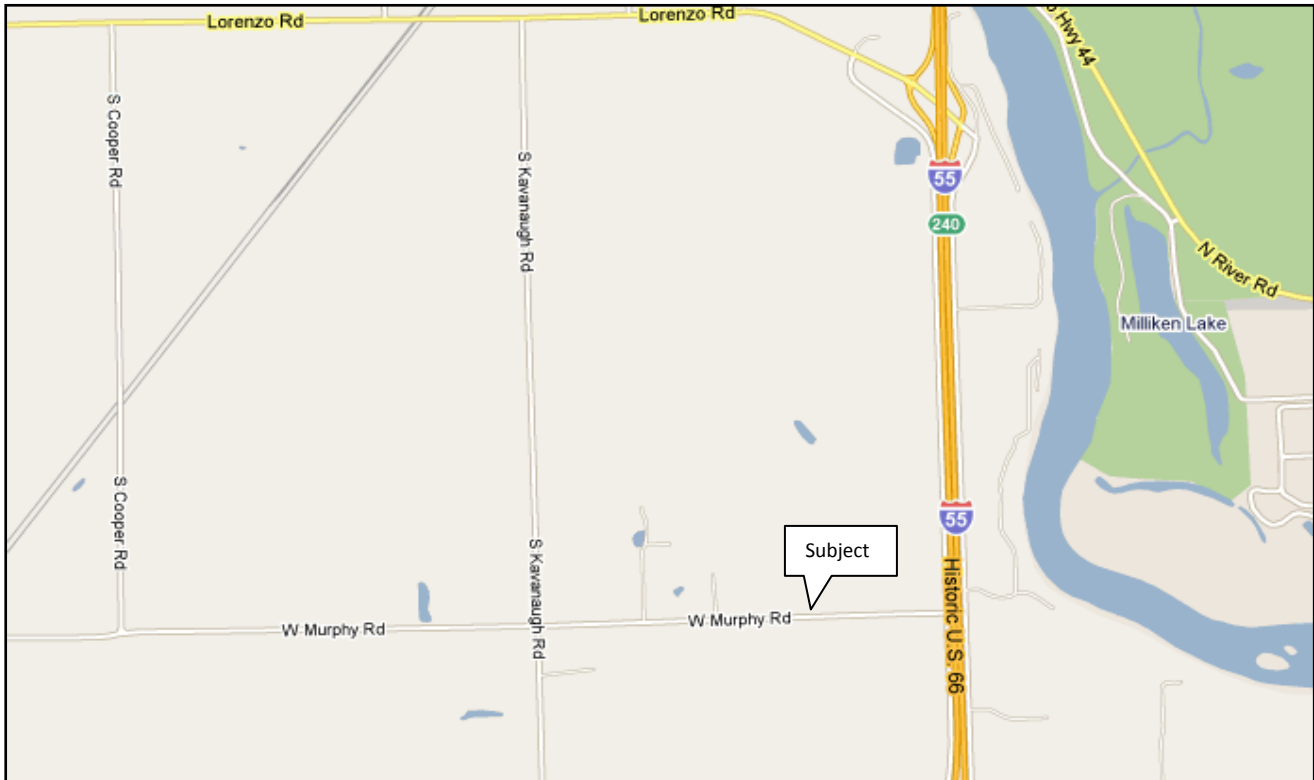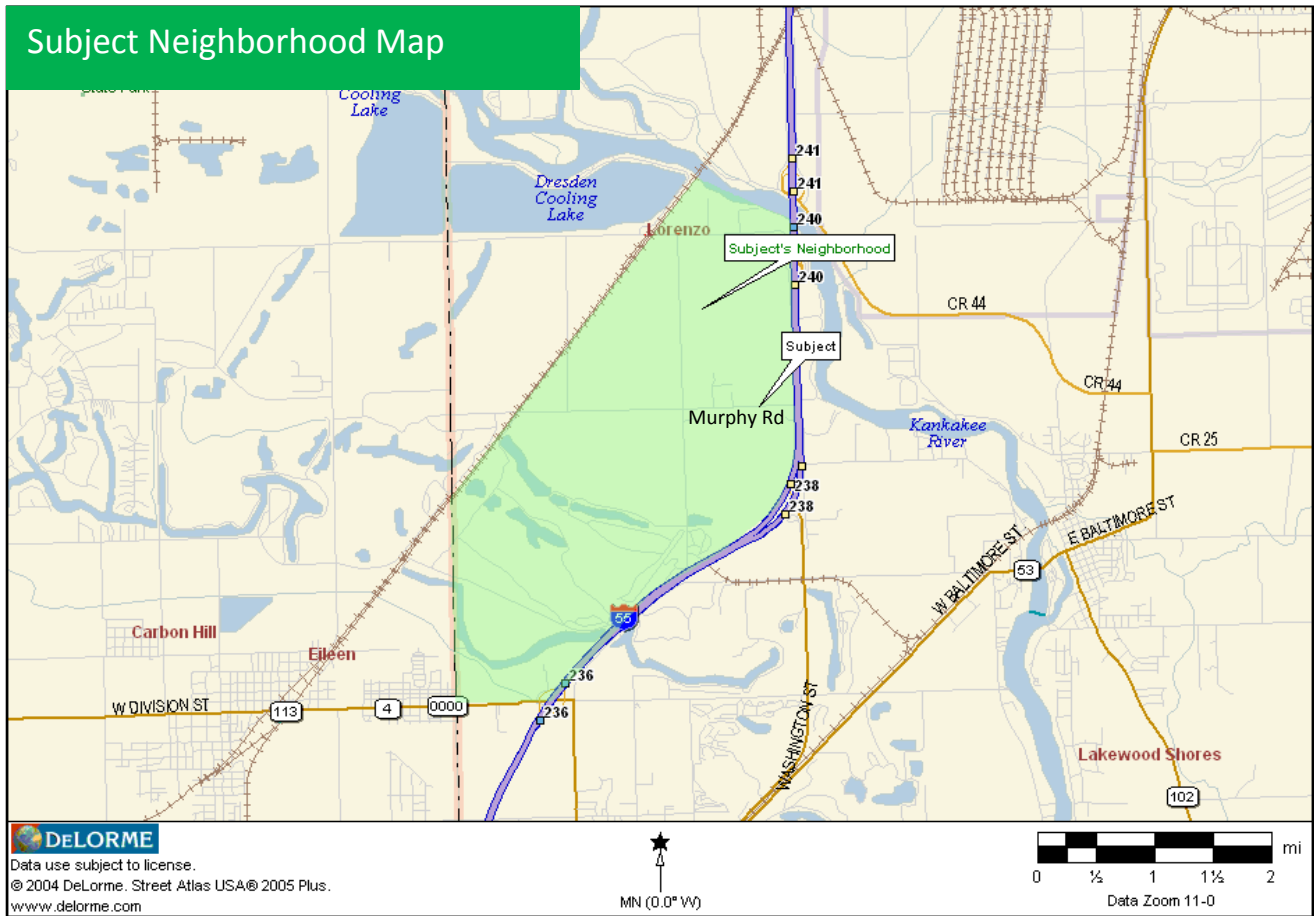
The primary retail development in the area is located just off I-55 (exit 240) along Lorenzo Road and consists of some retail and service oriented uses along with some retail/warehouse type uses. The land located near the intersection of Lorenzo Road and I-55 (exit 240) and along Lorenzo Road commands the highest value in the neighborhood due to the retail potential. The highest & best use in this well delineated area is retail.

A secondary district is located along Murphy Road (W. Murphy Rd.) and consists primarily of industrial uses mixed with residential and agricultural uses. The highest and best use for this area is industrial type use. It is typical in this district for industrial land sales to include older agricultural buildings or residential dwellings; however these buildings do not contribute to land value and are not representative of the highest and best use at the time of valuation. Typically, the demolition cost of these older agriculture buildings and residential dwellings are offset by the salvage value. Nearby points of interest include several industrial parks, Dresden Cooling Lake, and several nature preserves, along with the city of Joliet.

The neighborhood possesses an above average complement of public, educational, and recreational facilities. Accessibility to medical facilities, neighborhood shopping centers, areas of major employment and other complementary services is typical of similar socio-economic regions.

Economic growth has been consistent and stable in the subject area and is expected to continue in the foreseeable future. A strong employment base and employment opportunities are

present. I-55, I-57, and I-80 provide good access to the surrounding area including the Chicago

CMSA. No adverse conditions are detected in the subject's market area.

Subject Neighborhood Map

Note: Comparable Land Sales information remains the same as presented previously in Appendix 3E, and is not included in Appendix 3G.

Please list the land sales that are the <u>most similar</u> to the subject and used in your appraisal analysis (you may or may not need all of the available space).

	Comparable	Comparable	Comparable	Comparable
Street address				
Price				
Size				
Price Per Acre				

	Comparable	Comparable	Comparable	Comparable
Street Address				
Price				
Size				
Price Per Acre				

Please rank the comparables <u>previously listed</u> in order from most similar to least similar to the subject (you may or may not need all of the available space).

Ranking 1= most similar	Street Address

Exit Interview

1. Please list the most important factors in determining your value estimate:

2. Please list any information not contained in the case which would have been useful in your valuation analysis:

3. How confident do you feel about your value estimate:

    Least confident   Most Confident

    (Circle a number) |-------|-------|-------|-------|-------|------|-------|-------|-------|-------|

    0   1   2   3   4   5   6   7   8   9   10

    In the blanks below, show the upper and lower $/acre where you think there is a 90% probability (almost certain) that the true market value falls within this range.

    $_____/acre $_____/acre $_____/acre
    (Lowest)   (Your estimate)   (Highest)