Federal Reserve Bank of Chicago

Conference Invitation

Third Quarter 2004

Economic perspectives

Economic
perspectives

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ISSN 0164-0682

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3rd Quarter 2004, Volume XXVIII, Issue 3

The relationship between Hispanic residential location and homeownership

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Introduction and summary

For many families, homeownership is a foundation for financial asset building and future wealth accumulation. Increased homeownership has been linked to improved property maintenance, higher property values, greater community involvement, and enhanced neighborhood stability (Glaeser and Shapiro, 2002; Rohe and Stewart, 1996; and Cox, 1982). The opportunity for homeownership, therefore, contributes to a community's overall economic stability and growth.

The potential benefits of homeownership are not equally distributed across ethnic groups and ethnic communities. Although Hispanics represent the fastest growing minority/immigrant population in the U.S., their homeownership rate is among the lowest of any ethnic group. In 2000, close to 70 percent of U.S.-born households were homeowners; householders from Europe had a homeownership rate of 63 percent; and householders from Asia had a rate of 52 percent. By comparison, the homeownership rate for Latin American immigrants was 41 percent and 39 percent for Mexican immigrants specifically (U.S. Census Bureau, 2001).

Over the last few years the homeownership gap between Hispanics and non-Hispanics has narrowed. Between 1994 and 2002, the rate of homeownership for Hispanics increased by 17 percent, from 41.2 percent to 48.2 percent; while the rate for non-Hispanics increased by 6 percent from 65.9 percent to 70 percent (U.S. Census Bureau, 2003). Retsinas and Belsky (2002) suggest that the narrowing of this gap can be attributed in part to the increase in mortgage loans to low-income and minority households. Even so, as of 2002, more than a 20 percentage point gap in homeownership rates remained between Hispanics and non-Hispanics.[1] Recent increases in unemployment and foreclosures on homes owned by poorer minority families are stark reminders that closing the wealth gap through homeownership remains a challenge (Fleishman, 2002).

The Hispanic population in the U.S. has traditionally been concentrated in only a few states and in particular urban areas (Bartel, 1989). For a large proportion of immigrants, particularly those from Mexico or other Latin American countries, housing needs remain critical. For example, Mexican and other Latin American immigrants are much more likely to live in crowded and severely inadequate housing and/or to experience a severe housing cost burden (Lipman, 2003).[2] As a consequence, community development initiatives that respond to emerging and traditional immigrant communities may be very important.[3]

This study seeks to identify the socioeconomic, demographic, and life-cycle characteristics that influence the location choice and the homeownership decision for Hispanic immigrants. We ask two basic questions. First, is homeownership more or less likely for Hispanics who choose to reside in an ethnic location; and second, is the location decision jointly or endogenously made with the homeownership decision? Our findings suggest that, indeed, the location and homeownership decisions are jointly made. Furthermore, the decision to reside in a Hispanic enclave has a positive, significant influence on the likelihood of owning a home.

Overview of the literature

Most previous research on this subject has looked at immigrant homeownership within specific urban areas. For example, Schill et al. (1998) analyzed the experience of immigrants in New York City; and Hamilton and Cogswell (1997) looked at Hispanics in Syracuse. Our study contributes to the literature by examining the implications of ethnic geographic

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concentration on the homeownership decision of Hispanic households in the Chicago metropolitan area.

Research suggests that disparities in homeownership between immigrants and non-immigrants can be explained by differences in socioeconomic and demographic characteristics (for example, Pitkin et al., 1997; Myers and Lee, 1996 and 1998; and Myers et al., 1998). Coulson (1998) finds that Hispanics have a lower homeownership rate because Hispanic household heads tend to have less education, hold immigrant status, and are younger than non-Hispanics.[4] This study also points out that immigrant groups tend to concentrate in central cities where housing prices are relatively high, causing affordability constraints to be more binding.

Earlier, Krivo (1995) determined that the "immigrant context"[5] decreases the likelihood of homeownership among Hispanics in Los Angeles. However, the magnitude of this influence differs by Hispanic subgroup. Specifically, the negative effect of immigrant concentration on homeownership is more subdued for Mexicans than for non-Mexican Hispanics. At the same time, the Mexican "location context" tends to be more crowded with inferior or substandard quality housing. Alba and Logan (1992) find that, as the proportion of Mexicans and Cubans in a metropolitan area becomes larger, the likelihood of homeownership increases, while for other immigrant groups, such as Puerto Ricans and Vietnamese, the likelihood of homeownership decreases. More recently, Borjas (2002) argued that a sizable proportion of the homeownership gap is due to differences in the location decisions made by immigrants rather than their differences in socioeconomic background. He shows that in several major American cities, "ethnic clustering" increases the probability that immigrant households own their homes. He gives two potential explanations for this finding: first, housing prices in increasingly dense neighborhoods may encourage homeownership as an investment; and second, ethnic networks within enclaves can more effectively channel information flows about homeownership opportunities.

The body of existing literature agrees that ethnic enclaves have a direct impact on the homeownership decision, although views diverge about the direction of the effect. Still, a much less explored aspect of the analysis of homeownership is the fact that the choice of location is endogenous with the decision to be a homeowner. It is reasonable to assume that the decision to reside in an ethnic enclave is not a random process. A number of factors are likely to influence an immigrant's decision to choose an "enclave" rather than a location with only a sparse number of residents from their co-ethnic group.

Enclaves offer an alternative means of cushioning the relatively high cost of integration that some immigrants may face (Chiswick and Miller, 2002). Immigrants with less human capital, in terms of language, education, or labor skills, may have greater difficulty in adapting or assimilating to the new culture and, therefore, may need more of the support an ethnic enclave provides. For similar reasons, older immigrants also may choose such a location. Immigrants with less incentive to invest in learning to speak a new language, such as those who plan to repatriate at some point in the future, would tend to prefer to live with others who speak their language and share their culture. As such, unobserved factors that contribute to location choice might also influence the homeownership outcome of immigrants. The impact of ethnic enclaves on homeownership shown in previous research using conventional probit analysis techniques might be biased. In this article, we draw from the immigrant location choice literature and consider the *inside enclave/outside enclave* residential location decision to be endogenously or jointly determined with the homeownership decision.[6] We propose a bivariate probit technique to model the location and the homeownership decisions.[7] Our findings suggest that, for Hispanic immigrants, the location and homeownership decisions are jointly made. Moreover, the decision to reside in a Hispanic enclave has a positive, significant influence on the likelihood of owning a home.

Data and descriptive statistics

The data we use in this analysis are drawn from the public use micro statistics (PUMS) of the 1990 U.S. Census, 5 percent sample. The PUMS is advantageous because it provides a sample of Hispanics that is larger than other surveys such as the *American Housing Survey* or the *Current Population Survey*. Furthermore, it includes a wealth of information on immigrant status, mobility history, and language proficiency that are important for our study.

The Chicago metropolitan statistical area (MSA) is divided into 47 public use micro areas (PUMAs). PUMAs are the smallest geographical units defined by the 1990 PUMS in the public version of the data. Within the Chicago metropolitan area, we identify PUMAs that are heavily populated by Hispanics and compare them with other PUMAs that have fewer Hispanic residents. These smaller geographical units allow us to identify specific Hispanic areas and potentially to capture *ethnic enclave* or *ethnic affinity* effects. This is in contrast to previous studies that typically considered only cross-metropolitan variation effects in analyzing the homeownership decision (for example, Borjas, 2002).

While the Hispanic population in the sample made up 10 percent of the population of the entire Chicago MSA, one of the PUMAs had an 86 percent household population of Hispanic origin. (It combines South Lawndale, known as Little Village and the neighboring Lower West Side, known as Pilsen, two communities on the southwest side of the City of Chicago). Another PUMA had 58 percent of its household population of Hispanic origin. (It includes Rogers Park and Uptown on the north side). These two PUMAs comprise the Hispanic enclave with a majority Hispanic population. The remaining PUMAs (or "other locations" in our analysis) had a population less than 26 percent Hispanic, with most having 10 percent or less Hispanic households. The clear concentration of Hispanic households in the two PUMAs is consistent with the *inside-enclave/outside-enclave* pattern of choice observed for many other immigrant groups (Funkhouser and Ramos, 1993).

Table 1 provides the definition and mean value of variables for the Hispanic and other locations in the analysis. The sample includes Hispanic households residing in the Chicago MSA, with heads of household 18 to 64 years of age, who either own or rent their primary residence and who had positive household income. A striking difference between these two groups is that Hispanics with the most human capital tend to locate outside the areas with the largest concentration of Hispanics. Specifically, households in the Hispanic locations have on average less education and less proficiency in English. They also have been in the U.S. for a shorter period of time. A greater proportion of households living within the Hispanic locations also tend to have less income and lower homeownership rates.[8] The larger household size observed within the Hispanic locations is consistent with the findings reported for Hispanics in the Los Angeles metropolitan area (Krivo, 1995). Typical of immigrant groups and low-income households, mobility was fairly high (Kan, 2000). Forty-two percent moved to the Hispanic locations in the MSA from a different area within the state of Illinois; 10 percent came from a foreign country; and 3 percent moved from a different state in the U.S. Households in the Hispanic locations seem to be much less mobile than those in other locations; 45 percent of households in the Hispanic locations were nonmovers compared with 38 percent of those who resided in other locations. Surprisingly, movement across PUMA locations within the Chicago metropolitan area was a fairly uncommon occurrence—over the period observed, none had moved to the Hispanic locations from a different PUMA; and only 2 percent of individuals living in other locations undertook such a move.[9] There was in general a higher tendency for individuals to move in other locations in the Chicago MSA, as opposed to the Hispanic locations in the Chicago MSA, if they came from a different state or if they came from a different area outside the Chicago MSA.

Homeownership and ethnic enclave choice

We consider the following two-equation model to evaluate the possible linkage between two binary choices—the decision to own a home (OWNHOME) and the decision to reside in an enclave (HISPANIC LOCATION).

1) $y_1 = f_1(x_1, y_2)$, and

2) $y_2 = f_2(x_2)$.

In the first equation, the dependent variable, y_1 = OWNHOME, is equal to one if the householder owns their home and zero otherwise. Then, x_1 represents all exogenous variables on the right-hand side of the first equation. These include personal characteristics, such as socioeconomic, demographic, and life-cycle attributes, immigrant status, and assimilation indicator variables, and location characteristics, namely the relative price of owning a home versus renting. In addition, we assume that the decision to own is a function of location choice, y_2.

For the second equation, the dependent variable, y_2 = HISPANIC LOCATION, is equal to one if the household chooses to reside in a Hispanic ethnic enclave and zero otherwise. The variable x_2 represents a vector of right-hand indicator variables that include socioeconomic, demographic, and life-cycle attributes, and immigrant status characteristics. In addition, the covariates include indicator variables for the previous location of the households and whether they moved from abroad or from within the Chicago metropolitan area, as opposed to not having moved at all.

Note that the main aspect of the model is that y_2, or HISPANIC LOCATION, a covariate in the first equation, is also the dependent variable in the second equation—HISPANIC LOCATION is assumed to be endogenous. The model is therefore a recursive, simultaneous model. However, although we have two equations, the familiar simultaneous equation techniques (for example, two-stage least squares) are inappropriate because the model is nonlinear. We propose a bivariate probit model to ascertain whether the probability of choosing an ethnic enclave location (HISPANIC LOCATION) is jointly determined with the homeownership decision (OWNHOME).[10] Below, we explain the motivation behind our choice of covariates in each of the equations, then discuss the results.

TABLE 1

Descriptive statistics: Hispanics in the Chicago MSA

Variables	Definition of variables	Hispanic location	Other location
OWNHOME	1 if owns with mortgage or owns free and clear, 0 if renting	0.37	0.53
HISPANIC LOCATION	PUMA locations with 86% and 58% Hispanic population, respectively, 0 for all other PUMAs	1.0	–
COLLEGE	1 if college degree and beyond, 0 otherwise	0.01	0.03
HIGH SCHOOL	1 if HS diploma or equivalent, 0 otherwise	0.37	0.45
NO HIGH SCHOOL	1 if less than HS diploma, 0 otherwise	0.62	0.52
PERMANENT INCOME	Predicted values of log household income ($1990)	9.26	9.40
TRANSITORY INCOME	Residuals of log household income ($1990)	–0.06	0.02
MARRIED	1 if married, 0 otherwise	0.54	0.59
HHSIZE	1 number of persons in household	4.96	4.55
CHILDREN	1 if dependent children present, 0 otherwise	0.20	0.20
AGE 18–24	1 if age is 18 to 24, 0 otherwise	0.25	0.23
AGE 25–34	1 if age is 25 to 34, 0 otherwise	0.33	0.35
AGE 35–44	1 if age is 35 to 44, 0 otherwise	0.25	0.25
AGE 45–54	1 if age is 45 to 54, 0 otherwise.	0.12	0.11
AGE 55–64	1 if age is 55 to 64, 0 otherwise	0.05	0.06
MEXICO	1 if place of birth is Mexico, 0 otherwise.	0.56	0.45
NO ENGLISH	1 if speaks English "not well" or "not at all," 0 otherwise	0.36	0.24
US BORN	1 if born in U.S. or of American parents, 0 otherwise	0.23	0.34
NATURALIZED CITIZEN	1 if born abroad and naturalized, 0 otherwise	0.16	0.18
YSM5	1 if 5 or fewer years since migration, 0 otherwise	0.14	0.12
YSM6–10	1 if 6 to 10 years since migration, 0 otherwise	0.32	0.25
YSM11–20	1 if 11 to 20 years since migration, 0 otherwise	0.43	0.53
YSM21–30	1 if 21 to 30 years since migration, 0 otherwise	0.04	0.04
YSM31–40	1 if 31 to 40 years since migration, 0 otherwise	0.06	0.05
YSM41+	1 if over 40 years since migration, 0 otherwise	0.01	0.01
HOME VALUE	25th quartile of log value of home in PUMA	5.78	5.96
MEDIAN RENT	Median value of rent in PUMA	393.2	517.5
MOVE_PUMA	1 if moved across PUMAs in the Chicago MSA, 0 otherwise	0.00	0.02
MOVE_IL	1 if moved from an area in Illinois outside the Chicago MSA, 0 otherwise	0.42	0.47
MOVE_US	1 if moved from a different state in the U.S. outside of Illinois, 0 otherwise	0.03	0.05
MOVE_FOREIGN	1 if moved from a foreign country, 0 otherwise	0.10	0.09
NON MOVERS	1 if did not move in last 5 years, 0 otherwise	0.45	0.38
Sample size		3,752	10,374

Determinants of homeownership choice

Socioeconomic, demographic, and life-cycle characteristics

The choice of variables to include in the OWNHOME and HISPANIC LOCATION equations is guided by arguments and evidence from the literature and from the availability of variables in the data. There is agreement in the literature that the homeownership decision depends on socioeconomic, demographic, and life-cycle (including family structure) attributes (Goodman, 1990). Following this convention, marital status (MARRIED), size of the household (HHSIZE), whether dependent children are present (CHILDREN), and the age of the head of household (various age groups) are included. We expect these characteristics to capture the preferences for homeownership. Educational attainment is viewed as one potential indicator of wealth prospects, and we use it here as a proxy for the wealth-related taste for homeownership. We control for level of schooling using two indicator variables that reflect whether the head of household completed college or beyond (COLLEGE) or graduated from high school (HIGH SCHOOL). We expect that heads of household that have either a high school diploma or a college degree are more likely to be homeowners than those who have not completed high school.

We include household income to determine how nominal housing affordability influences the homeownership decision. As is customary, we include both permanent and transitory components of household income (Goodman and Kawai, 1982). Permanent income (PERMANENT INCOME) is the predicted value of the measured income estimated by a regression on a set of instrumental variables related to human capital and other demographic characteristics, while transitory income (TRANSITORY INCOME) is the difference between the observed measured household income and predicted income. We expect permanent income to have a positive influence on homeownership. Although included as a control, transitory income may be less important to the homeownership decision because the typical costs associated with the home purchase process (that is, transactions, search, and moving costs) are so substantial that they may not be covered by transitory income (Goodman, 1990).

Immigration and assimilation factors

The immigrant experience of Hispanics has important implications for homeownership outcomes for several reasons. Acquired English language fluency is an important human capital attribute for immigrants and an indicator of potentially greater integration into the mainstream financial system. We might expect that immigrants with greater English language fluency are more likely to be homeowners. However, in a Hispanic neighborhood where transactions may be conducted in Spanish, a lack of English language fluency may not necessarily hinder homeownership. We include the variable NO ENGLISH, whether householders reported that they speak English "not well" or "not at all," to determine the influence that this lack of human capital has on homeownership.

Second, lack of familiarity with the U.S. credit system may result in households being less informed about opportunities and programs that could help them purchase a home. The length of time a person has resided in the U.S., therefore, is important. From a lender's point of view, the length of time a person has resided at a particular address in the U.S. can be considered for lending qualification or underwriting purposes (Warren, 1995). The longer a person has resided in the U.S., the less their immigrant status should influence the likelihood of homeownership. We control for length of time since migration in a nonlinear fashion with dummies for incremental years since migration. For example, YSM5 is equal to one if the household head migrated less than five years prior to the survey. We also include an indicator variable for whether the householder is a U.S.-born citizen, US BORN (note, in this case, years since migration is equal to zero). We include whether the head of household is a naturalized citizen (NATURALIZED CITIZEN) as an indicator variable for integration or assimilation potential. The indicator variable, MEXICO, is equal to one if the head of household's birthplace is Mexico (or zero otherwise). We include this variable to control for potential differences in homeownership between Mexican and other Hispanic householders.

The location choice variable

We include HISPANIC LOCATION in the OWNHOME equation to measure the direct impact that the decision to reside in an ethnic enclave has on the likelihood of homeownership. Whether homeownership is more or less likely for households who choose to live in a Hispanic enclave is unclear from the literature. If the influence of Hispanic location has a significant and positive influence on the likelihood of homeownership, these two decisions are jointly made and residing in a Hispanic enclave increases the likelihood of homeownership. Alternatively, if the relationship between Hispanic location and homeownership is significant and negative, this implies that living in an enclave lowers the probability of owning a home.

Housing prices

Higher housing prices may lead to greater affordability constraints, especially for lower-income and more recent immigrant groups. Because other studies have shown that Hispanics have lower income levels relative to other ethnic/racial groups, affordability is likely to be relevant to their homeownership decision. Gyourko and Linneman (1996) used the 25th percentile of the log housing value in an MSA as an indicator variable to capture the costs of a typical inexpensive home and the median rent value to capture local housing prices. We follow their approach by including the 25th percentile of the log housing value in each PUMA (HOME VALUE) to control for local housing affordability. We also include the median rent in the PUMA (MEDIAN RENT) to control for the typical cost of renting in the PUMA. Areas with relatively high housing values or low rents may be expected to lengthen the transition to homeownership (Painter et al., 2000).

Determinants of enclave location choice

The independent variables in the second equation (HISPANIC LOCATION) comprise socioeconomic, demographic, and life-cycle characteristics, similar to the first equation. The inclusion of these personal characteristics in the location choice equation follows the immigration literature that suggests that individuals who choose to locate in enclaves tend to self-select in terms of personal attributes and as such tend to have relatively homogeneous personal characteristics. For example, individuals with less human capital, who are older, and who are not proficient in English may have greater difficulty in adapting to the new culture and may therefore prefer an enclave location. We include indicator variables for age, education, language proficiency, and assimilation factors, as previously defined, to assess the extent to which they impact the decision to reside in an ethnic enclave.

Typically, researchers have looked at the movement or mobility of households to better understand the location decision (Painter et al., 2000; Kan, 2000; and Boehm et al., 1991). Mobility is viewed as reflective of households' responses to variations in local labor market opportunities or differences in neighborhood amenities (for example, school quality). Households that experience greater geographical mobility are expected to have a greater proclivity toward spatial diversity and, therefore, are less likely to reside in a Hispanic enclave than their non-mover counterparts. Following previous research that shows that consideration for mobility is important to the location decision, our HISPANIC LOCATION model controls for geographic mobility. The variable MOVE_US indicates whether the head of household's residence five years earlier was in another state. The variable MOVE_IL indicates whether the individual moved from a different location within the state of Illinois to the Chicago metropolitan area, while MOVE_PUMA denotes whether a move was made across PUMAs within the Chicago metropolitan area.

Empirical results

Table 2 reports the results of the bivariate probit model.[11] Households that decide to live in a Hispanic location are significantly more likely to be homeowners. The significance of the location coefficient suggests that the homeownership decision is jointly made with the decision to locate in a Hispanic enclave.

Generally speaking, the likelihood of homeownership is greater for those with higher levels of education, permanent income, or those that are married, have larger families, or are U.S.-born or naturalized citizens. Conversely, those who are younger or have been in the U.S. for a shorter period of time are significantly less likely to be a homeowner.

Factors that influence the decision to locate in a Hispanic enclave are also shown in table 2. Those with higher education, greater permanent or transitory income, are more mobile, or are a U.S.-born or naturalized citizens are less likely to choose a Hispanic location.

Given that a household chooses to reside in a Hispanic enclave, the question becomes: How do the factors that determine this choice also influence the homeownership decision? The marginal effects reported in table 3 provide answers to this question. The marginal effects convey the magnitude and direction to which the different attributes influence the homeownership decision (OWNHOME = 1), in the case where a householder chooses to reside in a Hispanic enclave (HISPANIC LOCATION = 1).[12] As shown in table 3, householders residing in a Hispanic location who have a high school or college education (HIGH SCHOOL or COLLEGE) are approximately 3 percentage points and 6 percentage points, respectively, more likely to be homeowners than their less educated counterparts residing in a Hispanic enclave. Being married or having a larger family also increases the likelihood of owning a home for those living in a Hispanic enclave by 2.9 percentage points and 2.7 percentage points, respectively. Similarly, the likelihood of owning a home increases by 5.1 percentage points and 7.1 percentage points, respectively, for older respondents (AGE 45–54 and AGE 55–64) living in a Hispanic enclave relative to the comparison group (individuals between 35 and 45 years of age). Younger respondents residing in a Hispanic enclave, however, are significantly less likely to be homeowners. Specifically, the probability of homeownership for those between the age of 18 and 24 is lower by almost 2.2 percentage points, while the probability is 3.1 percentage points lower for those in the 25 to 34 age category.

The number of years since migration has a substantial influence on the likelihood that a resident of a Hispanic enclave is a homeowner. For example, individuals who migrated five years ago or fewer (YSM5) are almost 10 percentage points less likely to be a homeowner than those with 11–20 years since migration. Those who have been in the U.S. between 31 and 40 years are 6.2 percentage points more likely to be a homeowner than the comparison group. Naturalized citizens residing in a Hispanic enclave are 1.4 percentage points more likely to be homeowners, whereas U.S.-born citizens residing in a Hispanic enclave are 1.9 percentage points less likely to be homeowners.

Finally, an increase of 10 percent in home value for those residing in a Hispanic enclave lowers the probability of homeownership by 2 percentage points, while higher median rental prices increase the likelihood of homeownership by 1.3 percentage points.

TABLE 2				
Bivariate probit model				
Dependent variables	**OWNHOME**		**HISPANIC LOCATION**	
Intercept	2.35*	(0.40)	0.24**	(0.15)
HISPANIC LOCATION	1.01*	(0.08)	–	
Socioeconomic characteristics				
COLLEGE	0.34*	(0.07)	–0.38*	(0.09)
HIGH SCHOOL	0.19*	(0.02)	–0.09*	(0.03)
PERMANENT INCOME	0.09*	(0.01)	–0.06*	(0.01)
TRANSITORY INCOME	–0.0001	(0.00)	–0.0004*	(0.00)
Demographic and life-cycle characteristics				
MARRIED	0.22*	(0.02)	–0.16*	(0.03)
HHSIZE	0.10*	(0.01)	0.01*	(0.01)
CHILDREN	0.04	(0.03)	–0.03	(0.03)
AGE 18–24	–0.13*	(0.04)	0.05	(0.04)
AGE 25–34	–0.15*	(0.03)	0.03	(0.03)
AGE 45–54	0.21*	(0.04)	–0.04	(0.04)
AGE 55–64	0.33*	(0.05)	–0.14**	(0.06)
Immigration and assimilation factors				
MEXICO	0.03	(0.03)	–	
NO_ENGLISH	–0.37*	(0.03)	0.26*	(0.03)
US BORN	0.28*	(0.04)	–0.33*	(0.03)
NATURALIZED CITIZEN	0.18*	(0.03)	–0.20*	(0.03)
YSM5	–0.64*	(0.05)	–	
YSM6–10	–0.36*	(0.03)	–	
YSM21–30	0.14*	(0.05)	–	
YSM31–40	0.22*	(0.05)	–	
YSM41+	0.11	(0.12)	–	
Housing price variables				
HOME VALUE	–0.84*	(0.07)	–	
MEDIAN RENT	0.19*	(0.02)	–	
Mobility indicator variables				
MOVE_PUMA	–		–0.59*	(0.12)
MOVE_IL	–		–0.29*	(0.02)
MOVE_US	–		–0.59*	(0.06)
MOVE_FOREIGN	–		–0.43*	(0.04)
ρ (1,2)			–0.75*	(0.05)
Log likelihood			–16,038	.77

Notes: * Significant at less than 0.01. ** Significant at less than 0.05. Standard errors are in parentheses. The omitted education category is less than high school level education; the omitted age category is age 44 (ages 35 to 44); the omitted language category is "speak only English at home"; the omitted mobility category is NON_MOVERS.

In summary, by order of the magnitude of the marginal effects, positive influences on the decision to own for households residing in an enclave are life-cycle characteristics (being older), being in the country for a longer period of time, and being more educated. By contrast, some of the factors that are most potent in inhibiting this decision are being in the country for a shorter period of time and having a lack of proficiency in English.

It is worth noting that decomposing the marginal effects into direct and indirect effects reveals that the positive impact of the education variable on homeownership is somewhat lessened when one considers the indirect effect of having chosen an ethnic enclave location.[13] (For example, for the COLLEGE variable, the direct effect = 0.082; the indirect effect = –0.057; total effects as reported = 0.065). Moreover, the negative effect of English language deficiency on homeownership is less substantial when accounting for the location selection's indirect effect. (For the NO_ENGLISH variable, the direct effect = –0.893; indirect effect = 0.043; total effects as reported, = –0.860). This suggests that these human capital factors exert a somewhat lessened impact on homeownership in the context of an immigrant/ethnic enclave. This finding is consistent with the proposition that ethnic enclaves may serve as a more viable alternative for those individuals that possess less of these human capital attributes. Even so, these characteristics remain important to the homeownership decision inside enclaves.

TABLE 3

Marginal effects

Probability (OWNHOME = 1 | HISPANIC LOCATION = 1)

Variable	Marginal effect
COLLEGE	0.065*
HIGH SCHOOL	0.033*
PERMANENT INCOME	0.013*
TRANSITORY INCOME	–0.0001
MARRIED	0.029*
HHSIZE	0.027*
CHILDREN	0.066
AGE 18–24	–0.022*
AGE 25–34	–0.031*
AGE 45–54	0.051*
AGE 55–64	0.071*
MEXICO	0.006
NO ENGLISH	–0.146*
US BORN	–0.019*
NATURALIZED CITIZEN	0.014*
YSM5	–0.099*
YSM6–10	–0.074*
YSM21–30	0.040*
YSM31–40	0.062*
YSM41+	0.029
HOME VALUE	–0.202*
MEDIAN RENT	0.013*

Note: * Significant at less than .01 level.

Conclusion

The methodology developed in this article could be applied to other metropolitan areas. Indeed, we hope that this study will encourage researchers to conduct similar analyses for other areas, other racial/ethnic groups, and other time periods. Doing so will not only test the robustness of our approach but will also help inform policymakers about the determinants of immigrant homeownership in diverse settings. As a further consideration, the financial integration of immigrant households and whether these households have a banking relationship with mainstream financial markets will likely play an important role in determining whether they have access to credit for a home mortgage. Because Hispanic households are more likely to be unbanked (lacking a transactions account with a mainstream financial institution) than other ethnic/racial groups, their future prospects for homeownership opportunities may be hindered (Hogarth and O'Donnell, 1997; Greene et al., 2003). Future research may also benefit from an investigation of other factors that may be related to access to credit and financial services. These include attitudes toward borrowing and preferences for or access to alternative and/or informal credit sources.

New data from the 2000 U.S. Census points to a strikingly large dispersion of Hispanic communities across the Chicago metropolitan area. This suggests that Hispanic immigrant populations are mobile over time. Gains in human capital, such as English language proficiency and education, socioeconomic integration, and mobility outside of concentrated enclaves are likely to occur naturally in the long term. As such, we expect future homeownership rates to rise for Hispanics, potentially more so in locations outside of the traditional Hispanic enclaves.

NOTES

[1]There is also a large gap between black and white homeownership rates. Much of the recent literature has focused on the black–white differential (for example, Gyourko and Linneman, 1996; Munnel et al., 1996; Yinger, 1986).

[2]As defined by the American Housing Survey (AHS), a severe cost burden means that the housing costs exceed 50 percent of reported income and severely inadequate housing means that the housing has severe physical problems, including lack of reliable plumbing or heating or faulty wiring.

[3]Drew (2002) discusses the potential impact of immigrants on the U.S. housing market.

[4]Coulson used the 1996 *Current Population Survey* data.

[5]Krivo defines the "immigrant context" as an index incorporating the percentage of the population that is Hispanic and foreign-born, that is Hispanic and living in the U.S. ten years or less, and that is Hispanic and speaks English less than very well within the metropolitan area. Krivo's study is based on 1980 PUMS data.

[6]Studies that focus on native groups have used a multinomial/nested logit technique to model the location choices that tend to span across many places (for example, Deng et al., 2003).

[7]Borjas (2002) raises the issue of endogeneity of immigrant location choice and homeownership result estimates. To address this concern, he estimates a probit model of homeownership for the refugee population, which he approximates by classifying all immigrants who originate in main refugee-sending countries as refugees. The refugee countries included are Afghanistan, Bulgaria, Cambodia, Cuba, the former Czechoslovakia, Ethiopia, Hungary, Laos, Poland, Romania, Thailand, the former U.S.S.R, and Vietnam. His logic is that refugees have much less choice in deciding where to live than non-refugees and their location is randomly determined by sponsoring agencies. For our analysis of Hispanics, this approach was not warranted since Hispanics in the Chicago metropolitan area are mostly economic immigrants.

[8]The homeownership rate for Hispanics in the Chicago metropolitan area is 46 percent (Joint Center for Housing Studies, 1999).

[9]It is possible that some households moved from one neighborhood to another within the PUMA; our level of geographic grouping does not allow us to identify such movements.

[10]For the reader interested in a formal derivation of the bivariate probit, see Greene (2003), chapter 21, p. 716.

[11]As an extension of the probit model, the bivariate probit does not impose any stringent structure in terms of variables to be included in each of the equations for identification purposes. The OWNHOME equation does not include the mobility indicator variables that appear in the HISPANIC LOCATION equation, because inclusion of these variables (although arguably, they could be explanatory variables in the decision to own model), annihilates the effect of the location covariate in the OWNHOME equation—the model becomes overidentified. The second equation does not include the housing prices variables because they would be perfect predictors of location by construction—the price indicators are based on the PUMA's location housing prices. Years since migration variables were also omitted in the location choice model because of similar collinearity concerns.

[12]The second alternative, prob(OWNHOME = 1|HISPANIC LOCATION = 0) was also considered. Generally, the results mirror those reported in table 3 where HISPANIC LOCATION = 1. The results are available upon request from the senior author.

[13]The results in table 3 are the total marginal effects. An attribute's total marginal effect in the homeownership model is the sum of its direct and indirect effects. The direct effect is produced by the attribute's presence in the first equation, OWNHOME. The indirect effect is also produced if this same attribute is included in the second equation, HISPANIC LOCATION. Accordingly, the total marginal effect on OWNHOME is the sum of the direct and indirect effects for those attributes that are specified in both equations. Attributes that are included in the second equation directly influence the probability of choosing a Hispanic enclave. This effect is transmitted back to the first equation through the attribute, HISPANIC LOCATION, which appears in the OWNHOME equation, thus exerting the secondary, or indirect effect. Readers interested in more details about the marginal effects of the bivariate probit can consult Greene (2003).

REFERENCES

Alba, R. D., and J. R. Logan, 1992, "Assimilation and stratification in the homeownership patterns of racial and ethnic groups," *International Migration Review*, Vol. 26, No. 4, Winter, pp. 1314–1341.

Bartel, A., 1989, "Where do the new U.S. immigrants live?," *Journal of Labor Economics*, Vol. 7, No. 4, October, pp. 371–379.

Boehm, T. P., H. W. Herzog, Jr., and A. M. Schlottmann, 1991, "Intra-urban mobility, migration, and tenure choice," *The Review of Economics and Statistics*, Vol. 72, No. 1, February, pp. 59–68.

Borjas, J. G., 2002, "Homeownership in the immigrant population," Research Institute for Housing America, working paper, No. 02-01, March.

Chiswick, B., and P. W. Miller, 2002, "Do enclaves matter in immigrant adjustment?," University of Illinois at Chicago, Department of Economics, unpublished paper.

Coulson, E., 1998, "Why are Hispanic- and Asian-American homeownership rates so low? Immigration and other factors," *Journal of Urban Economics*, Vol. 45, pp. 209–227.

Cox, K., 1982, "Housing tenure and neighborhood activism," *Urban Affairs Quarterly*, Vol.18, pp. 107–129.

Deng, Y., S. L. Ross, and S. M. Wachter, 2003, "Racial differences in homeownership: The effect of residential location," *Regional Science and Urban Economics*, Vol. 33, No. 5, pp. 517–649.

Drew, R. B., 2002, "New Americans, new homeowners: The role and relevance of foreign-born first-time homebuyers in the U.S. housing market," Harvard University, Joint Center for Housing Studies, No. 2-2, August.

Fleishman, S., 2002, "2nd quarter foreclosure rates highest in 30 years," *The Washington Post*, September 14.

Funkhouser, E., and F. A. Ramos, 1993, "The choice of migration destination: Dominican and Cuban Americans to the mainland United States and Puerto Rico," *International Migration Review*, Vol. 27, pp. 537–556.

Glaeser, E. L., and J. M. Shapiro, 2002, "The benefits of the home mortgage interest deduction," Harvard Institute of Economic Research, discussion paper, No. 1979, October.

Goodman, A. C., 1990, "Demographics of individual housing demand," *Regional Science and Urban Economics,* Vol. 20, pp. 83–102.

Goodman, A. C., and M. Kawai, 1982, "Permanent income, hedonic prices, and demand for housing: New evidence," *Journal of Urban Economics*, Vol. 23, pp. 214–237.

Greene, W. H., 2003, *Econometric Analysis*, fifth edition, Upper Saddle River, NJ: Prentice Hall.

Greene, W. H., S. L. W. Rhine, and M. Toussaint-Comeau, 2003, "Who uses check-cashing businesses? A look at racial/ethnic differences," Federal Reserve Bank of Chicago, working paper, No. WP 2003-10.

Gyourko, J., and P. Linneman, 1996, "Analysis of the changing influences on traditional households' ownership patterns," *Journal of Urban Economics*, Vol. 39, pp. 318–341.

Hamilton, S., and S. J. H. Cogswell, 1997, "Barriers to home purchase for African-Americans and Hispanics in Syracuse," *Journal of Policy Development and Research*, U.S. Department of Housing and Urban Development, Vol. 3, No. 1, March, pp. 91–130.

Hogarth, J., and C. O'Donnell, 1997, "Being accountable: A descriptive study of unbanked households in the U.S.," Proceedings of the Association for Financial Counseling and Planning Education.

Joint Center for Housing Studies, 1999, *The State of the Nation's Housing*, Cambridge, MA: Harvard University.

Kan, K., 2000, "Dynamic modeling of housing tenure choice," *Journal of Urban Economics*, Vol. 48, No. 1, pp. 46–69.

Krivo, L., 1995, "Immigrant characteristics and Hispanic–Anglo housing inequality," *Demography*, Vol. 32, Issue 4, November, pp. 599–615.

Lipman, B. J., 2003, "America's newest working family: Cost, crowding, and conditions for immigrants," *New Century Housing*, Vol. 4, No. 3, July.

Munnel, A., L. E. Browned, J. McEneaney, and G. M. B. Tootel, 1996, "Mortgage lending in Boston: Interpreting HMDA data," *American Economic Review*, Vol. 86, pp. 25–53.

Myers, D., and S. W. Lee, 1998, "Immigrant trajectories into homeownership: A temporal analysis of residential assimilation," *International Migration Review*, Vol. 32, Fall, pp. 593–625.

__________, 1996, "Immigration cohorts and residential overcrowding in Southern California," *Demography*, Vol. 33, February, pp. 51–65.

Myers, D., I. Megbolugbe, and S. W. Lee, 1998, "Cohort estimation of homeownership attainment among native-born and immigrant populations," *Journal of Housing Research*, Vol. 9, pp. 237–269.

Painter, G., G. Stuart, and D. Myers, 2000, "The decision to own: The impact of race, ethnicity, and immigrant status," Research Institute for Housing America, working paper, No. 00-02, June.

Pitkin, J., D. Myers, P. Simmons, and I. Megbolugbe, 1997, "Immigration and housing in the United States: Trends and prospects," Fannie Mae Foundation, Washington, DC, report, May.

Retsinas, N. P., and E. S. Belsky, 2002, "Low-income homeownership: Examining the unequal goal," Washington D.C. Brookings Institution Press, available at www.brookings.edu/press/books/low_income_homeownership.htm.

Rohe, W. M., and L. Stewart, 1996, "Homeownership and neighborhood stability," *Housing Policy Debate,* Vol. 7, pp. 37–81.

Schill, M. H., S. Friedman, and E. Rosembaum, 1998, "The housing conditions of immigrants in New York City," *Journal of Housing Research*, Vol. 9, No. 2, pp. 201–235.

U.S. Census Bureau, 2004, *American Housing Survey*, Washington, DC, available at www.census.gov/hhes/www/ahs.html.

__________, 2003, *Homeownership Rates by Race and Ethnicity of Householder*, Washington, DC, available at www.infoplease.com/ipa/A0883976.html.

__________, 2001, "Profile of the foreign-born population in the United States: 2000," *Current Population Reports*, special studies, December, pp. 123–206.

Warren, D., 1995, "Fair lending and credit scoring," *Mortgage Banking*, Vol. 56, November, pp. 55–58.

Yinger, J., 1986, "Measuring racial discrimination with fair housing audits: Caught in the act," *American Economic Review*, Vol. 76, pp. 881–893.

FDIC losses in bank failures: Has FDICIA made a difference?

George G. Kaufman

Introduction and summary

Banks are generally failed and placed in receivership when the value of their assets declines below the value of their deposits and other debt, so that the value of their capital (net worth) becomes negative. The losses exceed the ability of the stockholders to absorb them. As a result, some of their creditors, and in the United States also the Federal Deposit Insurance Corporation (FDIC), which stands in the shoes of, at minimum, the insured depositors up to the insurance coverage ceiling, are likely to suffer losses. Because the FDIC is a federal government agency, if losses from bank failure resolutions are sufficiently high to exceed both the FDIC's reserves and its ability to collect additional revenues by levying sufficient premiums on insured banks to replenish the reserve fund, the losses may need to be paid by the government and thereby the taxpayers. Indeed, taxpayers were required to pay some $150 billion when losses incurred by the former insurer of deposits at savings and loan associations (S&Ls), the Federal Savings and Loan Insurance Corporation (FSLIC), in resolving the large number of failures in the S&L crisis of the 1980s exceeded its financial capacity to protect all insured deposits at these institutions against loss. Thus, the FDIC loss rate in resolutions is of concern to the uninsured depositors and other bank creditors who share in the loss with the FDIC, to the banks that pay insurance premiums, and to the taxpayers that are widely perceived to have backup liability.[1] It is in the best interest of all of these parties that the FDIC minimize its losses in failure resolutions.

Indeed, it is the losses from bank failures more than the bank failures themselves that are most damaging to both most stakeholders of the failed banks and the FDIC, so that it is more important to minimize this loss rate than the number of bank failures. Inefficient or unlucky banks that become insolvent should be permitted if not encouraged to exit, but with minimum losses.

In this article, I review both the causes of resolution losses to the FDIC and recent legislative and regulatory initiatives intended to reduce such losses, compute the loss rates experienced by the FDIC from 1980 through 2002, and compare and analyze the losses before and after the enactment of the FDIC Improvement Act (FDICIA) at year-end 1991, which, among other things, was intended to minimize such losses. I find that although the number of bank failures declined sharply after the implementation of FDICIA in 1993, the FDIC's loss rate increased significantly. This disturbing conclusion holds even after adjustment for changes in the size distribution of failed banks in the two periods. Only when the failed high-loss larger banks in the second period are also removed from the observations does the loss rate in the post-FDICIA period decline below that of the pre-FDICIA period. I conclude the article with speculation on why the FDIC's loss rate may have failed to decline and recommendations for enhancing the likelihood of loss reductions in the future.

These losses, however, are not necessarily the sole fault of the FDIC. Banks in the United States are declared insolvent and put into receivership or conservatorship under the FDIC by their chartering or primary federal regulatory agency, which is generally not the FDIC. Thus, the overall loss rate is in part determined by the embedded negative net worth of the bank at the time it is declared insolvent by these agencies and handed over to the FDIC.[2]

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Causes of FDIC losses

Unlike most other firms, chartered banks in the United States are not failed and placed into receivership by the federal bankruptcy courts and are not subject to the federal bankruptcy code.[3] Rather, they are failed and placed in receivership (or conservatorship if the institution is to be kept operating by the FDIC on a temporary basis) by their chartering or primary federal regulatory agency and are subject to the provisions of the Federal Deposit Insurance Act (FDIA). These differ significantly from the provisions of the corporate bankruptcy code.[4] The FDIC is generally appointed as the receiver, and the depositors and other creditors have no representation.[5] The loss rate to the FDIC in bank failure resolutions is determined by a number of factors, including how quickly a bank is placed in receivership or conservatorship after its net worth declines below zero, the relative importance of general creditors and uninsured depositors on the balance sheet, and the ability of the FDIC as receiver to sell the bank or its assets at the highest present value price. The longer insolvent, negative net worth banks are permitted to remain open and in operation under their existing management, either as a result of inadequate monitoring or forbearance by bank regulators, the larger their losses are likely to be on average. These institutions are likely to continue the inefficient operations that contributed to their insolvency and/or increase their risk taking and "gamble for resurrection." As the insolvent shareholders have no remaining investment in the bank, if they win their gamble they keep all the gains and possibly the bank and, if they lose, they lose their creditors' funds, not their own. On average, these bets are unlikely to pay off. Regulatory forbearance and inadequate monitoring have been costly in the past (Bartholomew, 1991; and Barth, Bartholomew, and Bradley, 1990; and Kaufman, 1995). The FDIA provides broad discretion to regulators in declaring an institution insolvent, but as amended by FDICIA requires an insured institution to be resolved within a brief period after its tangible equity declines to not less than, at minimum, 2 percent of its total assets.

Resolution losses to the FDIC are equal to the difference between the sum of the present value of the par value of insured deposits and of the recovery claim of uninsured deposits or non-deposit debt plus any protection that the FDIC decides to provide against loss at the insolvent bank being resolved and the lower present value of the recovery value of the bank as a whole or in parts. The lower any protection provided on uninsured claims and the larger the relative size of these claims, the more the FDIC is able to share any given resolution losses with others and reduce the size of the losses it bears.

The ability of the FDIC to protect uninsured claims and with whom and in what amounts it can share resolution losses are prescribed by law. Since the Depositor Preference Act of 1993, the FDIC's claim has had equal standing in liquidation with uninsured deposits at domestic offices of insured banks and priority over deposits at foreign offices of insured U.S. banks, general creditors, and other unsecured claimants. Before 1993, the FDIC had equal standing with all depositors and non-subordinated general creditors and priority only over subordinated creditors and equity claimants. Thus, for any given gross loss rate on a bank failure since 1993 and, in the absence of any protection of uninsured non-domestic deposit claimants, the larger the relative importance of non-domestic deposits and of general or subordinated creditors, the lower is the net loss rate to the FDIC. (The potential loss to the FDIC in resolving insolvencies with different liability structures is analyzed further in the appendix.)

Although the FDIC is required to protect all insured deposits at resolved banks fully against loss from par value, it has greater discretion in protecting uninsured deposits and other claims. Indeed, from 1980 through the enactment of FDICIA at year-end 1991, the FDIC effectively protected all uninsured deposits at all large resolved banks and, at times, even not very large banks and most non-deposit creditor claims (Benston and Kaufman, 1997).[6] The FDIC's discretion was reduced considerably but not eliminated altogether by FDICIA, a primary purpose of which was "to resolve the problems of insured depository institutions at least possible long-term cost to the deposit insurance fund." In general, FDICIA prohibits the FDIC from protecting any uninsured claims if doing so increases its losses, but there are exceptions. However, the exceptions are substantially more difficult for the FDIC to apply. To obtain a systemic risk exception (SRE), the FDIC must make a recommendation to the Secretary of the Treasury that not protecting some or all uninsured claims at a failed bank "would have serious adverse effects on economic conditions or financial stability and … [providing partial or complete protection] would avoid or mitigate such adverse effects."

The recommendation to the Secretary must be made in writing by a vote of no less than two-thirds of both the board of directors of the FDIC and the Board of Governors of the Federal Reserve System. The Secretary must then make the determination in consultation with the President. The Secretary must also maintain all documentation and notify the House and Senate banking committees. The basis for the determination and any subsequent actions are required to be reviewed by Congress' General Accounting Office (GAO). Furthermore, if the FDIC suffers any losses from providing the protection, the losses must be repaid expeditiously by all banks through a special FDIC assessment based on asset size. Thus, the cost of the protection is paid by the banks and is not passed through to the taxpayers. These provisions may be expected to significantly reduce the likelihood of FDIC protection for uninsured claimants, and since 1992 the FDIC has protected uninsured depositors only in a very few instances at small banks, where the acquiring bank bid a premium to assume the small amount of uninsured deposits that was greater than the pro-rata loss on these deposits.[7] In addition, in these resolutions, the FDIC avoided the costs of identifying and separating the insured and uninsured deposits on the bank's books.[8] Thus, protecting the uninsured deposits in these instances did not increase the FDIC's losses and was consistent with least cost resolution (Benston and Kaufman, 1997).[9]

Lastly, the higher the present value price received by the FDIC as receiver from the sale of the insolvent bank as a whole or in parcels, the lower is its loss. This may involve a tradeoff between waiting to sell the assets in a potentially stronger market at a higher future price that must be discounted back to the date of resolution and selling quickly at a lower price that requires less discounting. Evidence from the experience of both the U.S. in the 1980s and early 1990s and other countries suggests that, although not politically popular, quicker sales and resolutions, on average, achieve higher present values than delayed sales and resolutions, even in periods of widespread bank difficulties (Barth, 1991; Bartholomew, 1993; Ely and Varaiya, 1996; and Kane, 1990).

FDIC losses

The 1980s saw the largest number of bank and S&L failures in the U.S. since the Great Depression of the 1930s. Between 1983 and 1990, some 1,150 commercial banks, representing 8 percent of the industry in 1980, and some 900 S&Ls, representing fully 25 percent of the industry in 1980, failed and were put in receivership (Kaufman, 1995). Moreover, the associated combined losses to uninsured depositors, other stakeholders, and the FSLIC and FDIC were the highest in U.S. history. As noted earlier, the aggregate losses from the S&L failures alone exceeded the financial resources of the FSLIC to protect all insured depositors at its failed institutions and required an injection of some $150 billion of taxpayer funds. As a result, the FSLIC was dissolved by Congress and its deposit insurance functions transferred to a new Savings Association Insurance Fund (SAIF) housed in the FDIC.

The increase in S&L failures occurred before the increase in bank failures. When the number and size of bank failures picked up in the late 1980s and losses to the FDIC mounted, there was widespread fear that the banks would go the way of the S&Ls and the FDIC the way of the FSLIC. In response, Congress enacted FDICIA at year-end 1991. Among other provisions, FDICIA attempts to reduce losses to the FDIC from failure resolution by encouraging bank regulators to intervene sooner and more effectively in financially troubled banks to prevent their failure through prompt corrective action (PCA). And, if the intervention was unsuccessful, FDICIA authorized the FDIC to resolve these banks before their book net worth turned negative and, with the systemic risk exception noted above, not to protect any claims other than insured deposits if this would increase its losses and be inconsistent with least-cost resolution (LCR). The remainder of the article considers how successful this legislation and the bank regulators have been in reducing losses from failure resolutions.

Table 1 (overleaf) shows the losses incurred by the FDIC in 1,645 bank failures from 1980 though 2002.[10] Total losses in this period were $38.5 billion. As a percentage of the sum of on-balance-sheet bank assets on the date each bank was failed, losses averaged 12 percent. This is the loss rate to the FDIC. The table also shows aggregate losses by bank size. Most failed banks were small. Eighty percent had assets of less then $100 million and another 15 percent had assets between $100 and $500 million. Less than 1 percent of failed banks had assets in excess of $5 billion. The average aggregate loss rate varied with size. It was highest for small banks with assets of under $100 million and declined progressively with asset size from 21 percent to 6 percent for banks with assets in excess of $5 billion.[11] Although the loss rate was lowest for the largest banks, total dollar losses per bank were by far the largest at nearly $765 million at these banks, compared with only $6 million for banks with under $100 million in assets. Indeed, the largest 1 percent of all bank failures accounted for 20 percent of the FDIC's total losses.

Because more small than large banks failed, the loss rate computed as an average of individual bank loss rates—average of ratios, where each bank is weighted equally regardless of its size—was considerably higher at 21 percent. The rate again tended to decline with bank size. However, individual bank loss rates varied considerably, ranging from a low of 0 percent to a high of 75 percent in the failure of the First National Bank of Keystone (WV) in 1999, 72 percent in the failure of the BestBank (CO) in 1998, and 71 percent for WestPoint National Bank (San Antonio, TX) in 1988.[12] As can be seen from tables 2 and 3,

TABLE 1

FDIC losses on failure of BIF insured banks, 1980–2002

	Bank assets ($millions)					
	Under 100	100–500	500–1,000	1,000–5,000	Over 5,000	Total
1980–2002						
Number of banks[a]	1,313	241	42	39	10	1,645
Percent of number	79.82	14.65	2.55	2.37	0.61	100
Assets ($millions)	37,722	51,937	27,911	77,700	125,818	321,088
Percent of assets	11.75	16.18	8.69	24.20	39.18	100
Loss ($millions)	8,029	9,172	3,681	9,990	7,651	38,523
Percent of loss	20.84	23.81	9.56	25.93	19.86	100
Loss/assets (%)	21.28	17.66	13.19	12.86	6.08	12.00
Average of bank loss ratios (%)	22.30	17.33	12.97	13.84	7.26	21.04
Loss per bank ($millions)	6.11	38.06	87.64	256.15	765.10	23.42
1980–92						
Number of banks	1,247	217	40	37	10	1,551
Percent of number	80.40	13.99	2.58	2.39	0.64	100
Assets ($millions)	35,329	47,144	26,296	75,354	125,818	309,941
Percent of assets	11.40	15.21	8.48	24.31	40.59	100
Loss ($millions)	7,610	8,252	3,264	9,035	7,651	35,812
Percent of loss	21.25	23.04	9.11	25.23	21.36	100
Loss/assets (%)	21.54	17.50	12.41	11.99	6.08	11.55
Average of bank loss ratios (%)	22.56	17.15	12.23	12.21	7.26	21.19
Loss per bank ($millions)	6.10	38.03	81.60	244.2	765.10	23.09
1993–2002						
Number of banks	66	24	2	2	0	94
Percent of number	70.21	25.53	2.13	2.13	0	100
Assets ($millions)	2,393	4,793	1,615	2,346	0	11,147
Percent of assets	21.47	43.00	14.49	21.04	0	100
Loss ($millions)	419	921	417	955	0	2,711
Percent of loss	15.44	33.95	15.38	35.23	0	100
Loss/assets (%)	17.49	19.20	25.82	40.71	0	24.32
Average of bank loss ratios (%)	17.48	18.93	27.82	44.02	0	18.63
Loss per bank ($millions)	6.35	38.38	208.50	477.50	0	28.84
Loss rate for asset distribution in 1980–92[b] (%)	2.00	2.92	2.19	9.89	0	17.00
Loss rate omitting 2 outliers[c] (%)	17.49	19.20	12.79	13.46	0	17.35
Size normalized loss rate omitting 2 outliers[a] (%)	2.00	2.92	1.08	3.27	0	9.27

[a]All failed FDIC insured institutions from 1980 through 1989 and all failed BIF insured institutions 1990–2002. Omits 12 banks for which complete data are not available (11 banks in 1980–92 period and one bank in 1993–2002 period).

[b]Computed by weighting loss rates in 1993–2002 by percent asset distribution in 1980–92.

[c]Omits First National Bank of Keystone (WV) and NextBank (AZ).

Source: FDIC.

only 5 percent of all failures were resolved by the FDIC with effectively no loss and less than 25 percent with a loss of less than 10 percent of assets.

To examine the impact of FDICIA on FDIC losses in bank resolution, I divided the bank failures into a pre-FDICIA period (1980–92) and a post-FDICIA period (1993–2002).[13] The number of bank failures declined sharply in the later period from 1,551 to only 94. The average individual bank loss rate declined slightly from 21.2 percent to 18.6 percent, and the percentage of failures resolved with a loss of 10 percent or less increased from 22.4 percent to 31.9 percent. But the average aggregate loss rate to the FDIC more than doubled from 11.6 percent in the first period to 24.3 percent in the second, and the average loss per bank increased from $23.1 million to $28.8 million. Only for the smallest banks—those with assets of under $100 million—did the average loss rate not increase.

TABLE 2

Distribution of bank loss rates by bank size, 1980–2002

	Loss rate (%)								
Bank assets ($millions)	0–1	1.1–10	10.1–20	20.1–30	30.1–40	40.1–50	50.1–60	Above 60	Total
	(number of banks)								
Entire period: 1980–2002									
Under 100	49	197	371	362	195	93	28	18	1,313
100–500	30	57	70	40	24	14	3	3	241
500–1,000	5	13	13	7	3	1	0	0	42
1,000–5,000	2	17	10	8	1	0	0	1	39
5,000 or greater	1	6	2	1	0	0	0	0	10
Total	87	290	466	418	223	108	31	22	1,645
Period 1: 1980–1992									
Under 100	44	179	349	352	188	91	28	16	1,247
100–500	30	50	60	38	21	13	3	2	217
500–1,000	5	13	12	7	3	0	0	0	40
1,000–5,000	2	17	9	8	1	0	0	0	37
5,000 or greater	1	6	2	1	0	0	0	0	10
Total	82	265	432	406	213	104	31	18	1,551
Period 2: 1992–2002									
Under 100	5	18	22	10	7	2	0	2	66
100–500	0	7	10	2	3	1	0	1	24
500–1,000	0	0	1	0	0	1	0	0	2
1,000–5,000	0	0	1	0	0	0	0	1	2
5,000 or greater	0	0	0	0	0	0	0	0	0
Total	5	25	34	12	10	4	0	4	94

Source: FDIC.

Moreover, the FDIC loss rate in the second period likely understates the total losses suffered by all claimants in bank failures relative to the FDIC loss rate in the pre-1992 period. As noted earlier, FDICIA required the FDIC to share any losses with uninsured claimants, and depositor preference gave the FDIC priority over nondeposit creditors. This reduced its losses at the expense of these claimants. In contrast, before FDICIA, the FDIC frequently protected all uninsured claimants, particularly at larger banks, and absorbed the total loss (Benston and Kaufman, 1997, and 1998). Thus, its losses would have been larger for the same total loss from a bank failure.

The increase in loss to the FDIC in the post-FDICIA period appears to be inconsistent with both the intent of FDICIA and other legislative and regulatory initiatives in this period and the considerably smaller number of failures, which should have given the regulators more time to devote to each troubled bank under PCA before insolvency to design an LCR solution at insolvency (Eisenbeis and Wall, 2003). The increase suggests that the legislation may have been flawed and ineffective and/or that the regulators failed to vigorously implement its provisions. But the increase in loss rates may also be attributed to other factors, including a change in the size distribution of failed banks and a change in the incidence of major fraud or gross mismanagement as a cause of bank failure.

As noted, loss rates vary with size of bank, so that the average loss rate can change between two periods if the size composition of the failed banks changed, even if the loss rate in each size category did not. Table 1 shows that, proportionately, somewhat fewer very small—high loss rate—and very large—low loss rate—banks failed in the post-FDICIA period than in the pre-FDICIA period.[14] No very large banks (assets in excess of $5 billion) failed in the latter period. The relative increases were largest in the next to smallest category of banks. It is possible to estimate the impact on the loss rate of the change in the failed bank size distribution by weighting the loss rate in each of the five size classifications in the second period by the percentage of assets in banks that failed in that size group in the first period. When asset size distribution is held constant, so that the same asset size distribution of failed banks is assumed for the post-FDICIA period as occurred in the pre-FDICIA period, the aggregate average loss rate in the post-FDICIA period declines from 24 percent to 17 percent. But this is still considerably higher than the 12 percent in the earlier period and primarily reflects the absence of large low-loss banks in the second period. Thus, standardizing

TABLE 3

Percent distribution of bank loss rates by bank size, 1980–2002

Bank assets ($millions)	Loss rate (%) 0–1	1.1–10	10.1–20	20.1–30	30.1–40	40.1–50	50.1–60	Above 60	Total
	(percent of banks in each size group)								
Entire period: 1980–2002									
Under 100	3.73	15.00	28.26	27.57	14.85	7.08	2.14	1.37	100.00
100–500	12.45	23.65	29.05	16.60	9.96	5.81	1.24	1.24	100.00
500–1,000	11.90	30.95	30.95	16.67	7.14	2.38	0.00	0.00	100.00
1,000–5,000	5.13	43.59	25.64	20.51	2.56	0.00	0.00	2.56	100.00
5,000 or greater	10.00	60.00	20.00	10.00	0.00	0.00	0.00	0.00	100.00
Total	5.29	17.63	28.33	25.41	13.56	6.57	1.88	1.34	100.00
Period 1: 1980–92									
Under 100	3.53	14.35	27.99	28.23	15.08	7.30	2.25	1.28	100.00
100–500	13.82	23.04	27.65	17.51	9.68	5.99	1.38	0.92	100.00
500–1,000	12.50	32.50	30.00	17.50	7.50	0.00	0.00	0.00	100.00
1,000–5,000	5.41	45.95	24.32	21.62	2.70	0.00	0.00	0.00	100.00
5,000 or greater	10.00	60.00	20.00	10.00	0.00	0.00	0.00	0.00	100.00
Total	5.29	17.09	27.85	26.18	13.73	6.71	2.00	1.16	100.00
Period 2: 1992–2002									
Under 100	7.58	27.27	33.33	15.15	10.61	3.03	0.00	3.03	100.00
100–500	0.00	29.17	41.67	8.33	12.50	4.17	0.00	4.17	100.00
500–1,000	0.00	0.00	50.00	0.00	0.00	50.00	0.00	0.00	100.00
1,000–5,000	0.00	0.00	50.00	0.00	0.00	0.00	0.00	50.00	100.00
5,000 or greater	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
Total	5.32	26.60	36.17	12.77	10.64	4.26	0.00	4.26	100.00

Source: FDIC.

for size differences in the two sub-periods reduces but does not eliminate the increase in the FDIC loss rate.

Fraud is a major cause of bank failures in all periods, but may be expected to be relatively more important in good economic times, when few banks fail for economic reasons, than in bad economic times, when more banks fail for economic reasons. Fraud is by definition difficult to detect before failure and can lead to very large losses before it is detected relative to losses from other causes, which are generally easier to detect and to monitor. If so, losses from bank failures in the post-FDICIA period, which generally coincided with prosperous times, would be expected to be relatively higher than in the pre-FDICIA period, when the economy did not perform as well. In addition, a change in the size distribution of failures due to major fraud or gross mismanagement leading to large operating losses can also change the aggregate loss rate. If the presence of major fraud or gross mismanagement may be proxied by large losses, then there appears to be a slight increase in major fraud and gross mismanagement at larger banks in the post-FDICIA period. Two banks, First National Bank of Keystone (WV) in 1999 and NextBank (AZ) in 2002, with assets in excess of $500 million failed in the post-FDICIA period with loss rates in excess of 40 percent—the costliest 10 percent of all failures—compared with no such failures in the pre-FDICIA period, although the percentage of all failed banks with such large losses remained about the same in both periods.[15] These two banks accounted for the average loss per bank with assets between $500 million and $5 billion more than doubling in the second period.

If these two banks are removed from the analysis, the loss rate for the second period declines from 24.3 percent to 17.4 percent, but still remains significantly higher than in the earlier period. Only if both these two large-loss large banks are omitted and the second period is adjusted for changes in the size distribution of failed banks does the loss rate to the FDIC in the post-FDICIA period decline below that of the pre-FDICIA period. It declines to 9.3 percent. This suggests that both an increase in fraud and gross mismanagement at larger banks and a reduction in the overall number of very large bank failures, which generally incur substantially smaller loss rates, contributed to the increase in the aggregate loss rate in the post-FDICIA period, despite a decrease in the average individual bank loss rate.[16]

However, an analysis of the larger major fraud and gross mismanagement cases in recent years, including the analyses undertaken by the inspector generals of the respective federal regulatory agencies required by

FDICIA when the FDIC incurs material losses (defined as the larger of $25 million or 2 percent of the resolved bank's total assets), suggests that, among other things, the regulators either delayed on their own accord or were delayed by legal or other actions initiated by the target banks for considerable periods of time after the fraud or mismanagement problems were first detected (for example, Committee on Banking, 2002; U.S. Department of Treasury, 2000, 2000a, and 2002b; and FDIC, 2002). The larger the bank, the greater its incentive to delay the regulators in identifying fraud or gross mismanagement by adopting legal and other challenges to their investigations. To the extent that FDICIA emphasizes prompt corrective action by regulators, the high loss rate in the post-FDICIA period suggests that the regulators need to improve, in particular, their means of detecting fraud and gross mismanagement at larger banks and their reaction time in responding to such evidence.[17] The latter may require additional legislative and regulatory authority from Congress and possibly additional funding to reduce delaying actions by target banks without reducing appropriate due legal process or appeal procedures.

In almost all instances of large losses to the FDIC in recent years, the failed bank reported very rapid growth in assets, exceptionally high earnings on assets and/or equity, and well above average capital ratios shortly before its failure. Evidence over the past 25 years suggests that, while any one of these three measures in isolation does not signal problems and, in the case of earnings and capital is desirable, in combination all three represent a red warning flag (Duncan et al., 2003). In many instances, the actual data were significantly lower than the reported data as, among other things, troubled banks under-reserved for loan losses and overvalued other assets. Bank regulators have often been reminded in these failures that "if something looks too good to be true, it generally isn't true." This suggests that regulators can benefit by redeploying their examiners and supervisors to these banks more rapidly and aggressively. Reducing large losses at large banks is also important, because these are the losses that can reduce the FDIC's reserves significantly and may lead to required increases in insurance premiums on other banks, if the FDIC's reserves decline to less than 1.25 percent of insured deposits as specified in FDICIA, or, if losses are sufficiently large, even to taxpayer support, as in the late 1980s.

Conclusion

The analysis in this article suggests that a major objective of FDICIA of reducing the losses to the FDIC from bank failures has not been fully realized to date, despite a benign environment of few bank financial problems and a decline in the average individual bank loss rate. The large losses experienced by the FDIC in the post-FDICIA period relative to the 1980–92 pre-FDICIA period result primarily from large losses incurred in the resolution of a few larger banks. Nevertheless, these are the losses that reduce the FDIC's reserve ratio significantly and are more likely to reduce it below 1.25 percent. At this point, FDICIA requires increases in insurance premiums to restore the ratio. The large losses by the FDIC also indicate large losses by uninsured depositors and other creditors at resolved banks. As a result, the perception that bank failures have high costs is more likely to be maintained and is likely to increase support for public policies that focus on reimbursing depositors at failed banks for their losses rather than on reducing these losses through prompter and more effective regulatory intervention, including resolution before the bank's capital is fully dissipated as is envisioned in FDICIA. Because the latter is clearly the preferred policy in terms of maximizing aggregate social welfare, bank regulators may wish to focus their attention more on uncovering evidence of fraud and gross mismanagement at larger banks and to rely more heavily on readily visible, low-cost red flags of danger, such as unusually rapid growth rates and too-good-to-be-true profitability, to allocate their resources to reduce losses to the FDIC from smaller bank failures.

Again, it should be noted that, although the losses are charged to the FDIC, they are not necessarily the sole fault of the FDIC. Some of the losses were likely to have already been embedded in the banks when they were declared insolvent by their chartering or primary federal regulatory agency and handed over to the FDIC for resolution. Thus, part of the fault lies with bank management and part with the regulatory agency that declared the bank insolvent in not resolving it sooner. The FDIC's share of the loss blame generally begins only after the institution has become the FDIC's responsibility. In addition, these losses are not a condemnation of the PCA program in general. Both the number of failures and the magnitude of the losses may have been even greater in the absence of the PCA provisions. Indeed, the agencies used the powers of the program to successfully rehabilitate a significant percentage of financially troubled institutions before they became insolvent, thereby reducing potential later losses from insolvency (Comptroller of the Currency, 2003, and Salmon et al., 2003). If such application successfully continues and the above suggestions are adopted, at least in part, it is likely that future losses to the FDIC would decline to rates more consistent with the objectives of FDICIA.

NOTES

[1]The FDIC Improvement Act of 1991 potentially reduces significantly the backup liability of taxpayers for losses to the FDIC by requiring it to raise insurance premiums on banks whenever its reserves decline below 1.25 percent of total insured deposits, in order to replenish the insurance fund to this ratio within one year. The FDIC did not have this authority previously. Any taxpayer liability is and has in the past been implicit—never explicitly spelled out in legislation—but now is more likely to kick in only if the FDIC is unable to raise sufficient funds from higher premiums to keep the reserve ratio from declining below zero (Kaufman, 2001 and 2002, and Kaufman and Wallison, 2001).

[2]Because agencies other than the FDIC do not have the responsibly to reimburse depositors and other creditors of the banks they fail, they do not have their own money at stake. Thus, they may have some incentive to delay declaring a bank insolvent if they believe that the additional time granted may help the bank regain solvency and thereby remove a stain of failure on their watch from the record.

[3]Bank holding companies, in contrast, are failed and placed in receivership subject to the federal corporate bankruptcy code.

[4]An overview of the differences is discussed in Bliss and Kaufman (2004). The difference in the bankruptcy process between chartered banks and most other corporations has important i mplications for both the timing of legal failure and the losses to uninsured depositors, other creditors, and shareholders. Under FDICIA, the FDIC is subject to both a 2 percent tangible equity to assets closure rule and a least cost resolution provision. In contrast, legal failure for other firms generally occurs only after an actual (or, if voluntary, pending) default on a major scheduled debt or other payment, and bankruptcy courts in the U.S. tend to stretch out the rehabilitation process at high cost to creditors. Thus, it is reasonable to expect that insolvent banks are likely to be resolved sooner and with smaller losses to, at least, uninsured depositors than nonbank corporations.

[5]The process by which the FDIC resolves failed banks is described in Salmon et al. (2003) and Walter (2004).

[6]The FDIC's practice of protecting nearly all claimants in large resolutions before FDICIA gave rise to the misnamed phrase "too big to fail" (TBTF). Although perhaps not always on a timely basis, with rare exception, bank regulators did fail insolvent large banks in terms of terminating their shareholders' claims and transferring ownership and management to an assuming institution. Only in rare instances were insolvent large banks liquidated or closed physically as well as legally. The more accurate but longer term would have been "too large not to protect uninsured non-shareholder claimants." For a history of TBTF, see Kaufman (2004).

[7]The case that these restrictive provisions may be insufficient to prevent future bailouts of uninsured depositors at the very largest banks is made in Stern and Feldman (2004).

[8]Because the ex ante costs of administering the insurance computations when not protecting uninsured depositors are only estimates, the FDIC has some wiggle room in its determination of which resolution strategy represents least cost. However, it is likely that this leeway is significant only for resolving small banks with small amounts of uninsured deposits.

[9]As there have not been any very large bank failures since 1992, this procedure has not been fully tested.

[10]Failed and resolved banks include all failed institutions insured by the FDIC through 1989 and by the FDIC's BIF (Bank Insurance Fund) in 1990–2002. The population excludes S&Ls but includes some savings banks. The table excludes 12 relatively small banks for which loss information was not published by the FDIC. None of these banks had assets in excess of $500 million. Loss rates are reported by the FDIC as actual for completed resolutions and as estimates for resolutions in process. Thus, reported loss rates may change through time.

[11]The factors determining resolution losses at individual failed banks are analyzed in McDill (2004).

[12]One bank was reported to have been resolved with an eventual gain. A number of other banks may also have eventually been so resolved. Any gains are generally returned to subordinated creditors and shareholders.

[13]The post-FDICIA period starts in 1993 rather than 1992 because many of the provisions were not scheduled to be implemented until then (Benston and Kaufman, 1994).

[14]No adjustment is made for increases in bank size in the second period from inflation effects per se.

[15]Legally fraud is difficult to prove and regulators are frequently cautious in charging it. For example, among other things, NextBank periodically replaced nonperforming credit card loan—its only type of loan—with performing loans to collateralize loans that had been securitized and the resulting bonds sold, so that, contrary to appearances, it implicitly retained the credit risk of the "sold," off-the-balance-sheet loans. When the Comptroller of the Currency adjusted for this, the bank's regulatory risk-based capital was reduced from 17 percent to 5.4 percent. In addition, the bank apparently knowingly misclassified some credit losses as fraud losses, so as to avoid increasing loan loss reserves and decreasing reported capital. Nevertheless, the Inspector General of the Department of the Treasury concluded that the "failure can be attributed primarily to improperly managed rapid growth that led to unacceptable high levels of credit risk, losses, and operational problems" rather than to fraud (U.S. Department of the Treasury, 2002a, p. 5). Losses to the FDIC from the failure of NextBank are likely to be significantly larger than estimated at the time of closure because losses on its credit card loans increased significantly after closure but before the FDIC both sold the bank-owned portfolio and stopped servicing the portfolio that had been securitized and paid the owners of the outstanding bonds (Blackwell, 2002, and FDIC, 2003).

[16]In part, the FDIC may be expected to experience smaller loss rates on more recent large bank failures because, since the enactment of depositor preference in 1993, it has priority in liquidation to nondomestic deposits and other creditor claims, which tend to be most important at large money center banks. Thus, these funds absorb losses before they are charged to the FDIC or uninsured domestic deposits.

[17]Eisenbeis and Wall (2003) suggest that the regulators may be confusing minimizing bank failures with minimizing losses from bank failures and have inappropriately focused on the former at the expense of the latter. Eisenbeis and Wall also report no evidence that any one federal bank regulatory agency had a better track record in minimizing failure losses than the others.

APPENDIX: ACCOUNTING FOR LOSSES TO THE FDIC IN RESOLVING BANK INSOLVENCIES WITH DIFFERENT LIABILITY STRUCTURES

Since the enactment of the Depositor Preference Act in 1993, the FDIC, as receiver, is generally required to pay claims in insured bank resolutions in the following order as funds from the sale of the bank and its assets are received, except if the systemic risk exception that protects some or all *de jure* uninsured depositors and/or other creditors at the insolvent bank is invoked:

1. Administrative expenses of receiver,
2. Secured claims,
3. Depositors at domestic offices,
4. General unsecured creditors and depositors at foreign offices,
5. Subordinated debt holders, and
6. Stockholders.

Secured creditors are paid from the proceeds of the associated collateral. If this is insufficient to satisfy the full claim, they become general creditors for the remainder. Any excess collateral is returned to the bank. The FDIC effectively stands in the shoes of insured depositors and has equal priority with uninsured depositors. Thus, the size of any loss experienced by the FDIC in resolutions depends both on the shortfall in the market value of the bank's assets from the assigned value of its deposits and other debt and on the composition of the bank's liabilities. The former determines the overall loss and the latter the distribution among claimants. For example, the relatively less important are insured deposits, the more the FDIC can share its losses and the smaller is the loss to the FDIC for any given aggregate resolution loss. The relationship between bank liability structure and FDIC loss in resolutions may be demonstrated at greater length with the use of T accounts for a hypothetical, greatly over-simplified bank balance sheet.

Assume a bank that has only assets (A), insured deposits (ID), uninsured deposits (UD), unsecured other debt held by general creditors (OC), and equity capital or net worth held by shareholders (K). When solvent, its balance sheet looks as shown in table A1, panel A.

Assume now that the bank experiences a loss of $10. This can be shown by a $10 charge against assets, reducing their value from $100 to $90. The balance sheet would now be as shown in panel B.

Table A1

A)

	A	L	
A	100	40	ID
		40	UD
		10	OC
		10	K
Total	100	100	Total

B)

	A	L	
A	90	40	ID
		40	UD
		10	OC
		0	K
Total	90	90	Total

C) **Allocation of losses**

ID	0
UD	0
OC	0
K	10
FDIC	0
Total	10

Any loss is charged first to capital, which can absorb all of the $10 but is reduced to zero. The bank is declared insolvent by the FDIC and placed in receivership or sold at any positive price greater than zero. In this scenario, the FDIC, depositors, and other creditors do not suffer any loss (panel C). All the loss is borne solely by the shareholders. This reflects the theory underlying the closure rule at a nonnegative capital ratio in FDICIA. If successful, all depositors are fully protected and deposit insurance is effectively redundant.

But what if the FDIC was not able to resolve the institution before its losses exceeded its capital? Then some of the loss has to be charged against stakeholders with higher priority than shareholders. If the loss were $20, assets would now decline in value to $80 and capital would be a negative $10. But limited liability protects the shareholders from paying this full amount. Instead, they absorb only the first $10 of the loss, eliminating their ownership interest. The remaining $10 is charged against the general creditors, who have the next lowest priority. Depositors would still be whole and there is no loss to the FDIC. The balance sheet just before liquidation or sale would look like panel A in table A2.

Table A2

A)

	A	L	
A	80	40	ID
		40	UD
		0	OC
		0	K
Total	80	80	Total

B) **Allocation of losses**

ID	0
UD	0
OC	10
K	10
FDIC	0
Total	20

If the loss increases to $30—assets decline to $70—then depositors would also share in the loss. If the bank did not qualify for protection under the systemic risk exception, the additional $10 loss would be shared equally by the uninsured depositors and the FDIC standing in the shoes of the insured depositors. Because the FDIC must make the insured depositors whole at $40 when their deposits are valued at only $35, it effectively needs to pay $5 to the bank. This payment increases the bank's assets from $70 to $75 and its balance sheet immediately after failure may be shown as in table A3, panel A.

Table A3

A)

	A	L	
A	75	40	ID
		35	UD
		0	OC
		0	K
Total	75	75	Total

B)

Allocation of losses

ID	0
UD	5
OC	10
K	10
FDIC	5
Total	30

The FDIC's loss rate would be calculated by its loss as a percentage of the bank's total assets on the date of resolution before any infusion of funds by the FDIC. In this example, this would be $5/$70 or 7.1 percent.

But what if the FDIC obtains a systemic risk exception for the bank under FDICIA and acts to protect all depositors but not other creditors at par value? Then it would absorb the entire additional $10 loss and inject an additional $5 payment to the bank to make the uninsured as well as the insured depositors whole. This would increase assets from $70 to $80 as in table A4, panel A.

Table A4

A)

	A	L	
A	80	40	ID
		40	UD
		0	OC
		0	K
Total	80	80	Total

B)

Allocation of losses

ID	0
UD	0
OC	10
K	10
FDIC	10
Total	30

The FDIC's loss rate would double to 14.2 percent ($10/$70).

It is evident that capital, other debt, and uninsured deposits act as shock absorbers against losses for the FDIC and that the proportionately greater are these accounts, the proportionately smaller will be any loss to the FDIC from resolving a bank with a given negative net worth.

Alternatively, the FDIC may attempt not to fail the bank legally and invoke SRE to protect the other creditors as well as the uninsured depositors. Then, except for the $10 borne by the shareholders, the entire remaining $20 loss would be borne by the FDIC, which would make a $20 cash infusion to make all nonshareholder claimants whole. This would increase its loss rate again to 28.4 percent. The bank balance sheet would read as in table A5, panel A.

Table A5

A)

	A	L	
A	90	40	ID
		40	UD
		10	OC
		0	K
Total	90	80	Total

B)

Allocation of losses

ID	0
UD	0
OC	10
K	10
FDIC	20
Total	30

Lastly, it is also of interest to note how the loss allocations would have differed before the introduction of depositor preference in 1993. At that time, the FDIC did not have priority over other creditors (and deposits at foreign branches). The FDIC had equal standing with uninsured depositors and other creditors. Assume that the bank's balance sheet was as shown in table A1. A loss of $10 would not have affected the loss allocation. All of this amount would have been absorbed by the equity holders. But if the loss was greater than $10, the loss distribution would have been different. If the loss was $20, the $10 loss not absorbed by the equity holders would be divided proportionately among the FDIC, standing in the shoes of the insured depositors, the uninsured depositors, and the other creditors.[1] Each would have suffered a loss of 11 percent ($10/$90). The FDIC would have had to make a cash infusion of $4.44 (0.11 × $40) to the bank to offset the loss to the insured deposits. After the infusion, the balance sheet would have looked like panel A of table A6.

Table A6

A)

	A	L	
A	84.44	40.00	ID
		35.56	UD
		8.88	OC
		0	K
Total	84.44	84.44	Total

B) **Allocation of losses**

ID	0
UD	4.44
OC	1.12
K	10.00
FDIC	4.44
Total	20.00

The FDIC's loss rate would be $4.44/$80 or 5.5 percent, compared with 0 percent after depositor preference. Thus, the FDIC and the uninsured depositors would both have been worse off and the other creditors better off (see table A2).

Likewise, if the loss was $30 and the systemic risk exemption was not invoked, the $20 not borne by the shareholders would be borne proportionately by the three other claimant classes. This would compute to 22 percent ($20/$90 = 0.22) of claims of each class. For the FDIC, this would amount to $8.88. The bank balance sheet would be as shown in table A7, panel A.

Table A7

A)

	A	L	
A	78.88	40.00	ID
		31.12	UD
		7.76	OC
		0	K
Total	78.88	78.88	Total

B) **Allocation of losses**

ID	0
UD	8.88
OC	2.24
K	10.00
FDIC	8.88
Total	30.00

Thus, without depositor preference, the FDIC would have lost $8.88, or $3.88 more than in table A4, when it lost only $5.00, and its loss rate would have been 12.7 percent ($8.88/$70), up from 7.1 percent with depositor preference.

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[1]A more thorough analysis of the implications of depositor preference appears in Kaufman (1997) and Marino and Bennett (1999).

Barth, James R., 1991, "Testimony," U.S. House of Representatives, Committee of Banking, Finance, and Urban Affairs, Task Force on the Resolution Trust Corporation on the Structure of the Savings and Loan Bailout, Washington, DC, July.

Barth, James R., Philip F. Bartholomew, and Michael G. Bradley, 1990, "Determinants of thrift institution resolution costs," *Journal of Finance*, July, pp. 731–754.

Bartholomew, Philip F., 1993, *Resolving the Thrift Crisis*, Washington, DC: Congressional Budget Office, April.

__________, 1991, *The Cost of Forbearance during the Thrift Crisis*, Washington, DC: Congressional Budget Office, June.

Benston, George J., and George G. Kaufman, 1998, "Deposit insurance reform in the FDIC Improvement Act: The experience to date," *Economic Perspectives*, Federal Reserve Bank of Chicago, Second Quarter, pp. 1–20.

_________, 1997, "FDICIA: After five years," *Journal of Economic Perspectives*, Summer, pp. 139–158.

__________, 1994, "The intellectual history of the Federal Deposit Insurance Corporation Improvement Act of 1991," in *Reforming Financial Institutions and Markets in the United States*, George Kaufman (ed.), Boston: Kluwer Publishers, pp. 1–17.

Blackwell, Rob, 2002, "The resolution of NextBank: Did FDIC make costly blunder?," *American Banker*, December 26, pp. 1, 4.

Bliss, Robert, and George G. Kaufman, 2004, "Corporate bankruptcy versus bank bankruptcy: A comparison of insolvency regimes," Loyola University Chicago, working paper, October.

Comptroller of the Currency, 2003, *Annual Report: Fiscal Year 2003*, Washington, DC, November.

Duncan, Martha C., Walter Ashby, Pat Cowherd, Eric Dahlstrom II, Kathleen Frantum, Diane Geeslin Bunch, Greg Haag, Philip M. Robertson, Rand Roan, Margo Standley, and Gregory Watson, 2003, "The root causes of bank failures," Federal Deposit Insurance Corporation, working paper, August 30.

Eisenbeis, Robert A., and Paul M. Horvitz, 1994, "The role of forbearance and its costs in handling troubled and failed depository institutions," in *Reforming Financial Institutions and Markets in the United States*, George Kaufman (ed.), Boston: Kluwer Academic, pp. 49–68.

Eisenbeis, Robert A., and Larry D. Wall, 2003, "The major supervisory initiatives post-FDICIA: Are they based on the goals of PCA? Should they be?," in *Prompt Corrective Action in Banking: 10 Years Later*, George Kaufman (ed.), Oxford: Elsevier Science, pp. 109–142.

Ely, David P., and Nikhil P. Varaiya, 1996, "Opportunity costs incurred by the RTC in cleaning up S&L insolvencies," *Quarterly Review of Economics and Finance*, Fall, pp. 291–310.

Federal Deposit Insurance Corporation, Office of Inspector General, 2002, *Issues Related to the Failure of Superior Bank, FSB, Hinsdale, Illinois*, Washington, DC, February 6, No. 02-005.

__________, 2003, *The Division of Resolutions and Receiverships' Resolution and Management of Credit Card Portfolios*, Washington, DC, April 17, No. 03-029.

Kane, Edward J., 1990, "Principal–agent problems in S&L salvage," *Journal of Finance*, July, pp. 755–764.

Kaufman, George G., 2004, "Too big to fail: Quo vadis," in *Too-Big-To-Fail: Policies and Practices*, Benton Gup (ed.), Westport, CT: Praeger, pp. 153–167.

__________, 2002, "FDIC reform: Don't put taxpayers back at risk," Cato Institute, policy analysis paper, April 16.

__________, 2001, "Reforming deposit insurance—Once again," *Chicago Fed Letter*, Federal Reserve Bank of Chicago, November.

__________, 1997, "The New Depositor Preference Act," *Managerial Finance*, Vol. 23, No. 11, pp. 56–63.

__________, 1995, "The U.S. banking debacle of the 1980s," *The Financier*, May, pp. 9–26.

Kaufman, George G., and Peter J. Wallison, 2001, "The new safety net," *Regulation*, Summer, pp. 28–34.

Marino, James A., and Rosalind L. Bennett, 1999, "The consequences of national depositor preference," *FDIC Banking Review*, Vol. 12, No. 2, pp. 19–38.

McDill, Kathleen M., 2004, "Resolution costs and the business cycle," Federal Deposit Insurance Corporation, working paper, No. 2004-01, March.

Salmon, Richard, Lisa Allston, Jeanne McBride, Dennis Trimper, Elvis Nelson, Debbie Barr, Beth Almond, Gwen Hudson, Donna Kinser, and Vicki Robinson, 2003, "Costs associated with bank failures," Federal Deposit Insurance Corporation, working paper, October 10.

Stern, Gary H., and Ron Feldman, 2004, *Too Big to Fail: The Hazards of Bank Bailouts*, Washington, DC: Brookings Institution Press.

U.S. Department of the Treasury, Office of Inspector General, 2002a, *Material Loss Review of NextBank, NA*, Washington, DC, No. 01G-03-024, November 26.

__________, 2002b, *Material Loss Review of Hamilton Bank, NA*, Washington, DC, No. 01G-03-032, December 17.

__________, 2000, *Material Loss Review of The First National Bank of Keystone*, *WV*, Washington, DC, No. 01G-00-067, March 10.

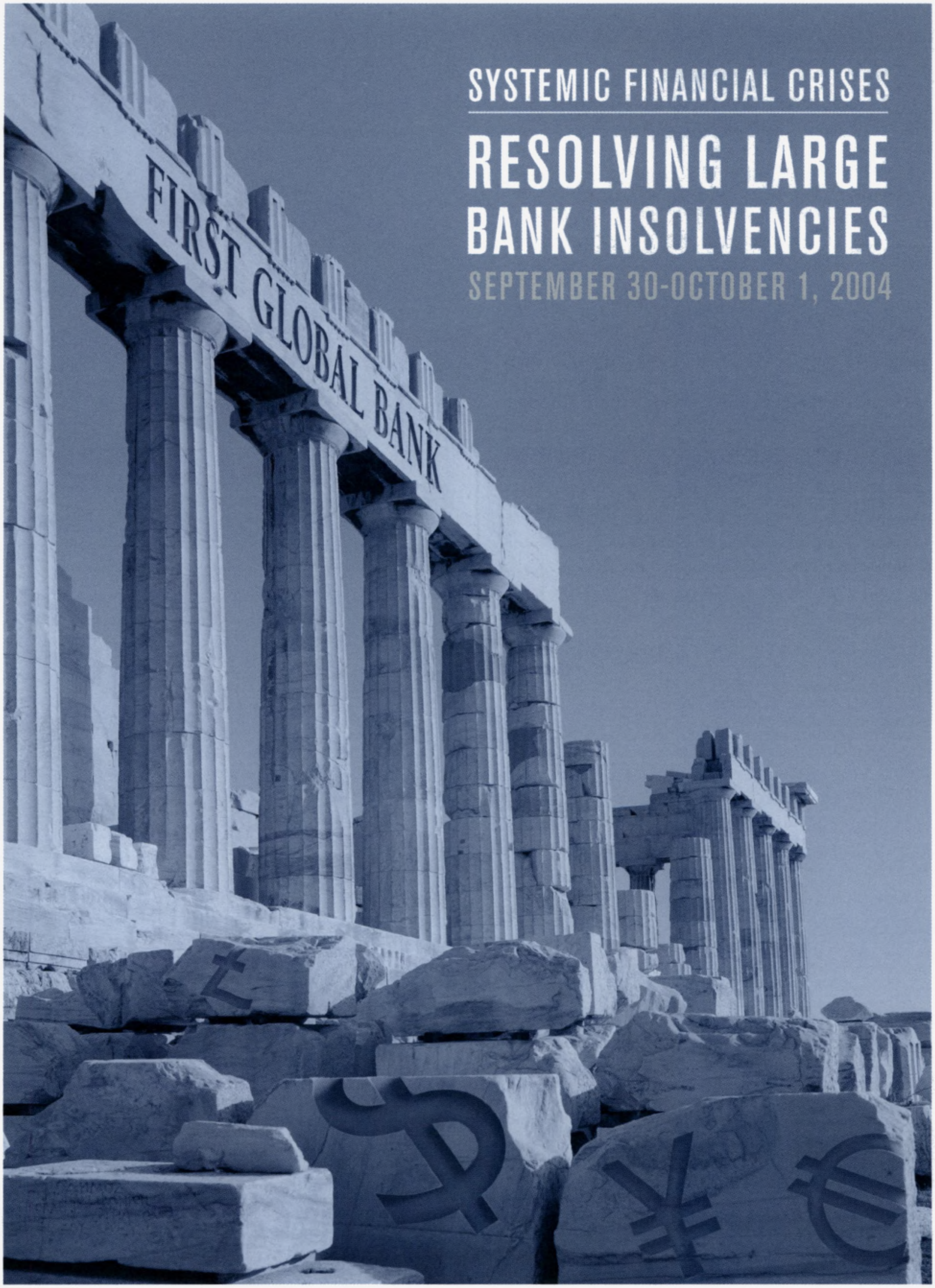
United States Senate, Committee on Banking, Housing and Urban Affairs, 2002, *The Failure of Superior Bank, FSB, Hinsdale, Illinois* (S. Hrg. 107-698), September 11 and October 16, 2001, WV, Washington, DC: U.S. Government Printing Office.

Walter, John R., 2004, "Closing troubled banks: How the process works," *Economic Review*, Federal Reserve Bank of Richmond, Winter, pp. 51–68.

SYSTEMIC FINANCIAL CRISES

RESOLVING LARGE BANK INSOLVENCIES

SEPTEMBER 30-OCTOBER 1, 2004



On September 30 and October 1, the Federal Reserve Bank of Chicago will hold the seventh in a series of international conferences focusing on important policy issues in global economics and finance. The conference will be held at the Federal Reserve Bank's Conference Center—230 South LaSalle, Chicago—and will feature internationally recognized speakers from a number of countries.

The conference will explore how to resolve large insolvent banks at the lowest cost to the economy. Like illness, death, and taxes, bank failures in both developed and emerging economies are a fact of life and will occur in the future as they have in the past. Unfortunately, past large bank failures have often been resolved inefficiently at a cost to both taxpayers and the economy as a whole. The conference will review past resolutions, discuss the key policy challenges to efficient resolution, develop strategies for improving the resolution process, and stress the importance of developing plans for resolving failures while the banking system is healthy and having them "on the shelf" and ready to go when failures occur. The content of the conference will be targeted to an international audience of financial industry practitioners, regulators, policymakers, and academics.

As you review the program (available at www.chicagofed.org), you will note the conference speakers are both experts in the area and represent a wide array of affiliations from an equally wide array of countries. Keynote speakers include Timothy F. Geithner, President of the Federal Reserve Bank of New York, Andrew Crockett, President of J. P. Morgan Chase International, and Alan Bollard, Governor of the Reserve Bank of New Zealand. Other speakers include representatives from the Federal Deposit Insurance Corporation, the International Monetary Fund, the International Association of Deposit Insurers, the Federal Reserve System, the Swiss Banking Commission, the Bank of England, Bank of Finland, Bank of Japan, the Netherlands Ministry of Finance, and an array of academic institutions.

Conference attendance will be limited to allow for active participation by all attendees. As a result, conference reservations will be accepted on a first-entered basis. Information about conference registration and hotel reservations is available on the Federal Reserve Bank of Chicago's website (www.chicagofed.org). Please note that our deadline for conference registration at the reduced rate is September 10, 2004. The special rates and reserved room block at the two conference hotels are available for reservations received at the hotel before August 29, 2004. Additional questions should be directed to Ms. Regina Langston: 312-322-5814 or rlangston@frbchi.org.

We hope you can join us for this important and timely global conference.

House prices and the proposed expansion of Chicago's O'Hare Airport

Daniel P. McMillen

Introduction and summary

Controversial plans to expand Chicago O'Hare Airport would add an additional runway and reconfigure the seven existing runways. The proposed expansion would allow the airport to handle 1.6 million flights annually, up from approximately 928,000 in 2003. O'Hare is not alone in having expansion plans: 18 of the 31 large hub airports in the U.S. are planning to add runways in the next decade. As of 2001, these 31 airports accounted for 70 percent of U.S. air passengers, and the top 25 of these airports accounted for 86 percent of all severe air traffic delays. However, neighboring communities often oppose airport expansions, and the O'Hare expansion plans are particularly controversial. O'Hare is surrounded by a densely populated ring of suburban municipalities whose residents already complain about the noise generated by flights in and out of O'Hare.

Airports are both a direct and indirect source of employment. The area around O'Hare Airport rivals downtown Chicago in terms of number of jobs. Data from the Northeastern Illinois Planning Commission show that there were about 800,000 jobs located within five miles of downtown Chicago in 2000. More than 400,000 jobs were located within five miles of O'Hare in 2000, and about 950,000 jobs *in the suburbs* were located within a ten-mile radius of O'Hare Airport. But airports are also the source of traffic congestion, air pollution, and noise. Airport expansion plans frequently encounter strident opposition due to these unfavorable characteristics, despite the potential for more jobs.

In this article, I use recent data on sales of single-family homes to estimate the effect of noise on property values in the area around O'Hare Airport. Home values are frequently used as the basis for estimating the costs of "disamenities" such as noise. Polinsky and Shavell (1976) present the theoretical underpinnings of the standard approach, while Bartik and Smith (1987) and Sheppard (1999) provide reviews of the theory and relevant applications. The idea is simple and compelling: People generally are well informed when they make an important decision such as the purchase of a new home. They may be willing to live in an area that is subject to severe noise, but only if they receive a discount on their home price. The size of the discount measures their aversion to high aircraft noise. Home prices have been used to measure the costs of such disamenities as air pollution (Zabel and Kiel, 2000) and traffic noise (Theebe, 2004), as well as the benefits of amenities such as school quality (Black, 1999). The effects of airport expansions on home prices are important politically. A possible drop in property values is frequently cited as a key motivation for opposing new runways.

I find that home values are 10 percent lower in areas that are subject to severe noise. This noise discount may explain some of the opposition to the airport expansion. In addition to the direct suffering caused by noise, homeowners may logically expect a nearly 60 percent increase in flights to lead to a large drop in property values. But paradoxically, noise levels may actually fall after the proposed O'Hare expansion. Older, noisy aircraft are being retired and airlines are switching to quieter planes. Regional carriers, which are projected to account for a higher percentage of flights in the future, use small and comparatively quiet aircraft. Indeed, the area that is defined by the FAA (Federal Aviation Authority) as being subject to severe noise fell from 57 square miles in 1997 to 38 square miles in 2000. The severe-noise area is projected to decline further to 27 square miles after the expansion and reconfiguration of the airport. These trends suggest that noise reductions will cause the average home in an area that formerly was subject to severe noise to *increase*

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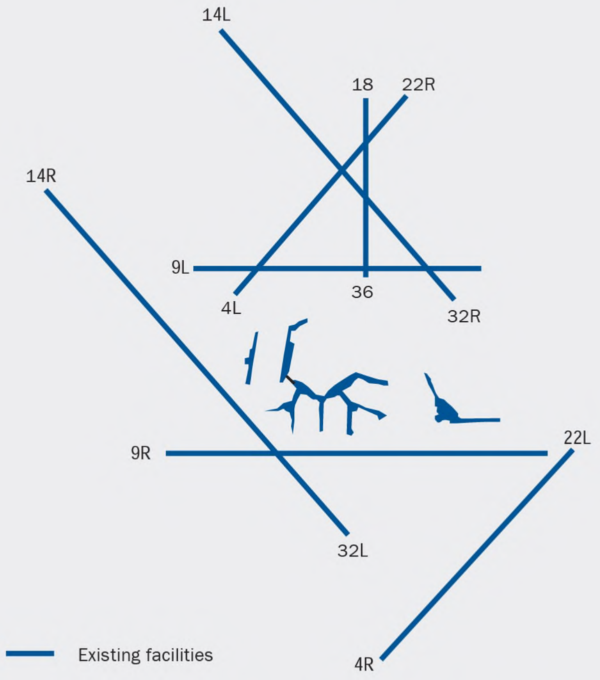
in value by as much as $17,000 (in 1997 dollars) between 1997 and the time after the expansion.

These results partially undermine one of the primary arguments against airport expansions. An important caveat is in order, however. Although the results suggest that prices may rise even if traffic at O'Hare increases significantly, they do not show how much prices would have increased if the airport remained at its current capacity. With aircraft getting significantly quieter over time, prices would presumably rise even more if the number of flights did not increase beyond current levels in the future. Nevertheless, the finding that the number of flights at an airport can increase by nearly 60 percent without generating significantly higher noise levels is a surprising result, tempering arguments against an expansion.

FIGURE 1

Existing runways



Source: http://modernization.ohare.com/program_pages/configuration.htm.

The proposed O'Hare expansion

Chicago is currently served by two airports, O'Hare and Midway. Midway opened first in 1926. O'Hare opened in 1955 and quickly overtook Midway as Chicago's busiest airport. In 2003, O'Hare served approximately 928,000 flights, compared with 328,000 at Midway. The number of flights continues to increase as airlines switch to smaller planes. Partly due to the move to smaller aircraft, load factors (the percentage of seats that are occupied) have risen from about 60 percent in the late 1970s to more than 70 percent today, and the FAA projects a continued increase. The FAA estimates that nearly 650 billion passengers were served nationally by U.S. commercial airlines in 2003, and their projections call for the number to increase to 1,124 billion in 2015.[1]

The hub and spoke system places enormous pressure on the capacity of large hub airports such as O'Hare. Hubs operate by gathering larger numbers of flights from feeder airports and sending passengers on as quickly as possible to their ultimate destinations. As a major hub in the center of the county, O'Hare contends with Atlanta for the title of the world's busiest airport. It also is currently a major bottleneck for U.S. air traffic. The year 2003 saw 11,960 late arrivals at O'Hare, or 20.28 percent of all arriving flights.[2] The delays lead to further delays at other airports as the effects ripple through the entire system. By changing the current configuration of the airport and adding another runway, the proposed expansion is intended to reduce delays at O'Hare and elsewhere.

The existing runway configuration at O'Hare is shown in figure 1. Two runways have an east–west orientation, two run northeast–southwest, and another two have a northwest–southeast orientation. A seventh runway runs due north–south. Unfortunately, all but one of the runways intersect another. The safety concerns caused by this inefficient configuration reduce the number of flights that the airport can handle, particularly in conditions of poor visibility.

Although the expansion plans are still in flux, figure 2 shows a recent proposal. The two northwest–southeast runways would be removed. Most flights would be handled by six parallel east–west runways. Although there still is some debate over how far apart these runways must be to handle simultaneous operations, the idea is that landings and takeoffs could occur at the same time on different runways. The remaining two northeast–southwest runways would only be used in extreme weather conditions. The more efficient configuration would permit the number of flights to increase by nearly 60 percent, even though there would only be one additional runway—for a total of eight rather than seven.

The O'Hare expansion is not the only plan under consideration. The primary contending plan is to build a new airport in Peotone, Illinois, which is located about 40 miles south of downtown Chicago along I-57. As early as the 1960s, Major Richard J. Daley proposed building a new airport on landfill in Lake Michigan. A site near Lake Calumet on the city's south side was proposed as the site of a second airport in 1929, but this site was rejected in favor of O'Hare.[3] The Lake Calumet site continues to be proposed as a candidate for the location of a third airport. Another proposal is to expand the existing airport in Gary, Indiana.

The expansion plans are very controversial, and nearby suburbs have actively opposed them. The opposition is based in part on fears of additional noise and traffic congestion. In addition, politics has permeated the decision process:

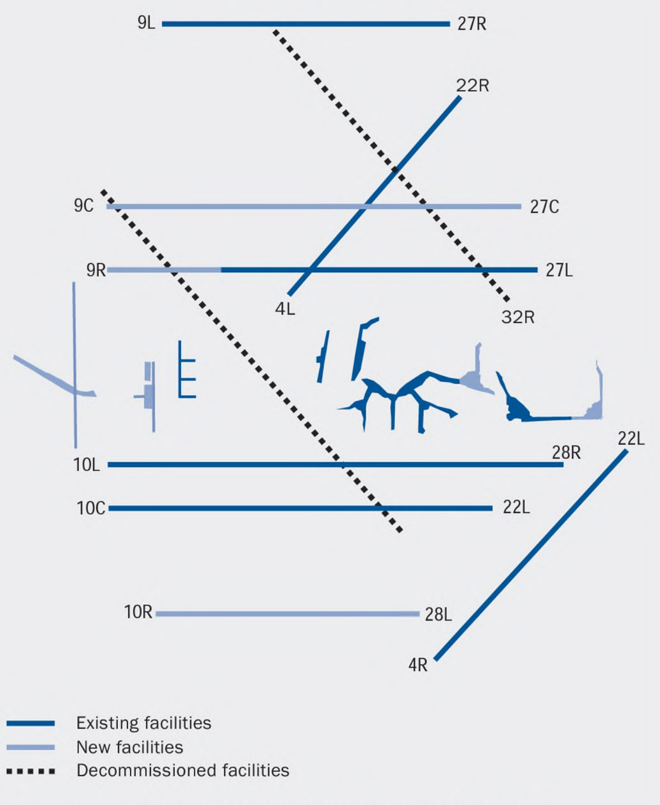
> From the start, O'Hare was used by City Hall as a means to reward political allies. Richard J. Daley's administration, for instance, gave the right to sell flight insurance to a company that had hired Daley's City Council floor leader, Thomas Keane, and it handed millions of dollars in construction work to another company that employed Keane. … O'Hare helps [Richard M.] Daley at election time. Airport vendors, concessionaires, and other businesses tied to O'Hare—and their executives and lobbyists—donated about $360,000 to Daley's campaign in an 18-month period beginning in July 1998. … Due to the length of Daley's tenure, he has hired nearly 60 percent of the 1,900 employees who work for the city's Department of Aviation, which manages O'Hare, Midway and Meigs Field. (Martin and Cohen, 2000.)

The Peotone and Gary proposals call for the construction of an airport outside of the City of Chicago. Although suburban and downstate legislators have been supportive of the Peotone proposal, Chicago has consistently opposed it. The airlines tend to prefer the O'Hare expansion, in part because O'Hare has a proven record and it is unclear whether passengers would be drawn to a Peotone airport. Hub airports rely on local passengers as well as those who are simply transferring en route to other destinations, and O'Hare is closer to downtown Chicago than Peotone and is closer to firms that account for a major portion of lucrative business travel. It is unclear whether a Peotone airport would successfully draw passengers away from O'Hare who are simply transferring through the Chicago area. The federal government has given mixed signals over time, sometimes supporting the O'Hare expansion and other times preferring a third airport.[4]

In the face of this debate, Governor Blagojevich of Illinois signed legislation in August 2003 authorizing the expansion of O'Hare. Chicago submitted its expansion plan to the FAA in October 2003. The city hopes to begin construction in fall of 2004. However, Chicago cannot begin construction or receive federal funding for the expansion until it receives FAA approval. Delays in the approval process mean that the odds are low that construction will begin in the next year. In the meantime, the controversy over the expansion plans casts a cloud of uncertainty over the housing market in the area around O'Hare.

FIGURE 2

Proposed expansion plan



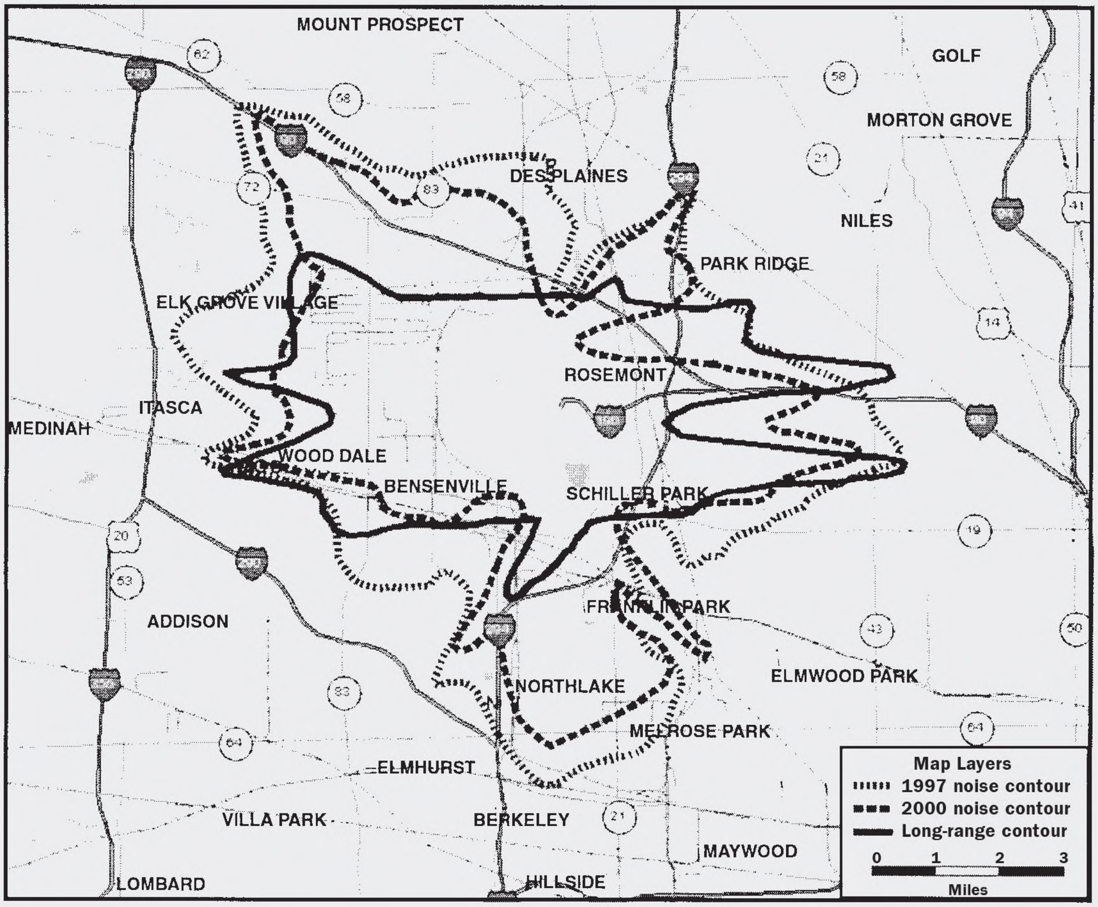
Source: http://modernization.ohare.com/program_pages/configuration.htm.

Noise contours

The FAA requires airports throughout the country to continually monitor noise

FIGURE 3

Noise contours



levels. O'Hare maintains a system of 31 permanent noise-monitoring stations. Another ten mobile monitors respond to specific complaints. Together, the monitors record more than five million data points each day, which are then used to measure monthly average decibel (db) levels. A ten-decibel penalty is included for times between 10 p.m. and 7 a.m. (for example, a 60-db reading at 11 p.m. is recorded as 70 db). The FAA and HUD (the U.S. Department of Housing and Urban Development) define areas exposed to average decibel readings in excess of 65 db as incompatible with residential housing.

Figure 3 shows 65-db noise contour bands for 1997 and 2000. It also shows a projected contour band for the time after the proposed expansion. Areas within the noise contours have average decibel readings in excess of 65 db. Although the entire area shown in figure 3 suffers to some extent from aircraft noise, I will refer to the area within the 65-db band as the "noisy" or "severe-noise" area and the area outside the band as the "quiet" area.

The 1997 and 2000 noise contour bands show clearly the effects of quiet aircraft. The area covered by the 65-db contour band shrinks from 57 to 38 square miles. The overall shape of the contour bands hints at the current inefficient runway layout, in which important runways cross. A common pattern is for flights to take off to the west or northwest, while landings frequently come from the east or south. This tendency leads to the long extensions of the noise contour bands to the northwest, east, and south. With no change in the runway layout between 1997 and 2000, the 2000 noise contour fits inside the 1997 contour, with roughly the same shape.

The post-expansion ("long-range") contour band has an entirely different shape. One of the objectives of the expansion is to create a more efficient layout by eliminating crossings. The new runway configuration will allow multiple flights to take off and land simultaneously. The new layout produces a much narrower long-range contour band. Significant noise reductions take place to the northwest and south of the airport. The only significant areas with increases in noise are east of the airport, along the landing approaches to the new runways.

A combination of forest preserve, light industry, commercial buildings, and homes surrounds O'Hare Airport. McMillen (2004) presents evidence that aircraft noise reduces the value of residential properties in this area but does not have an effect on industrial or commercial properties. Figure 3 shows that very few square miles are expected to have higher noise levels after the proposed expansion. However, the expansion could lead to a large reduction in property values if the areas with higher noise levels are densely populated residential neighborhoods. Thus, the next step in the analysis is to prepare an accounting of homes according to noise contour status.

The Illinois Department of Revenue provided transactions data for all single-family homes in Cook County for 1996–2001. Of these sales, 22,541 were located within two miles of the 1997 noise contour, which is the area chosen for study. Table 1 shows the distribution of sales by noise contour status. More than 77 percent—17,418—of the transactions are homes that were located on the quieter side of the noise contour in both 1997 and 2000. More homes (2,574) switched from the noisy to the quiet side between 1997 and 2000 than remained on the severe-noise side during both years (2,327). Only 222 of the sales were homes that switched from the quiet side of the 1997 contour to the severe-noise side of the 2000 contour. These trends are projected to continue between 2000 and the time after the proposed expansion, with 2,086 sales switching from the severe-noise side of the 2000 contour to the quieter side of the long-range contour and only 706 switching from the quieter to severe-noise side. The percentage of sales on the severe-noise side of the boundary falls from 21.7 percent in 1997 to 11.3 percent in 2000 to 5.2 percent after the expansion.

Table 1 shows that the geographic distribution of home sales is not skewed toward locations that are adversely affected by the proposed runway reconfiguration. Although the results are not shown here, an analysis of the geographic distribution of a census of all homes is not different from the distribution of the subsample of those that sold. Homes are far more likely to have switched from the severe-noise side to the quieter side of the noise contours than to have gone in the other direction. Most homes are already experiencing a reduction in noise, and the trend is forecasted to continue even after the expansion.

The noise discount

Homes that are subject to severe noise sell at a discount. Many studies use a traditional hedonic approach (Bartik and Smith, 1987; Polinsky and Shavell, 1976; Shephard, 1999) to estimate the noise discount. The hedonic approach decomposes a home's price into its various attributes, such as lot size, building square footage, and the number of bedrooms. Controlling for such housing characteristics is critical because homeowners may react to low land prices near the airport by substituting toward big homes on large lots. A simple comparison of average sales would understate the noise discount.

In a review of the initial wave of studies of house prices, Nelson (1980, p. 46) concludes, "a survey of evidence from thirteen studies suggests noise discounts in the range of 0.4 to 1.1 percent per decibel." Recent studies include Collins (1994); Espey and Lopez (2000); Feitelson, Hurd, and Mudge (1996); Levesque (1994); O'Byrne, Nelson, and Seneca (1985); and Pennington, Topham, and Ward (1990). All of these find that airport noise significantly reduces property values; a detailed comparison can be found in McMillen (2004).

In McMillen (2004), I find that homes around O'Hare Airport sold at nearly a 10 percent discount in

TABLE 1

Number of house sales by noise contour status

	Quiet 2000	Noise 2000	Quiet long range	Noise long range	Total
Quiet 1997	17,418	222	17,458	182	17,640
Noise 1997	2,574	2,327	3,914	987	4,901
Quiet 2000			19,286	706	19,992
Noise 2000			2,086	463	2,549
Total	19,992	2,549	21,372	1,169	22,541

Source: Calculations based on Illinois Department of Revenue data.

1997 if they were located within a 65-db noise contour band. In this article, I expand on that study in several ways. First, I now have sales data for 1996–2001 rather than just 1997. The additional data allow me to determine whether the noise discount is changing over time. Second, I use two methods to estimate the noise discount. In addition to the standard specification, which uses a simple dummy variable to represent locations that are subject to severe noise, I estimate a model using a continuous measure of exposure to noise—distance from the 1997 noise contour band. Finally, I expand on my previous work by estimating whether home prices appreciated more rapidly in areas that experienced significant reductions in noise between 1997 and 2000.

The Illinois Department of Revenue data provide the necessary information on sales prices for 1996 to 2001. However, the Department of Revenue does not collect any information on the characteristics of the homes. The Cook County Assessor's Office made their 1997 file available for this study. This file allows me to merge standard housing characteristics with the sales price data. Details on the construction of the dataset are provided in McMillen (2004).

Descriptive statistics are provided in table 2. The Assessor's Office file provided standard housing characteristics, such as building square footage, land area, age, and the number of bedrooms. I supplemented these variables with measures of proximity to standard amenities—the Chicago central business district (CBD), the entrance to O'Hare (the intersection of I-294 and the Kennedy expressway), stops on the elevated train line, commuter stations, and highway interchanges. I also include a variable indicating that a home is within one-eighth of a mile of a rail line, which is the regular length of a city block in Chicago's grid street system. As a proxy for neighborhood quality, I include the median income in 2000 for the census tract as an explanatory variable.

I include two measures of aircraft noise. The first is a simple dummy variable indicating that a home is located within the 1997 noise contour band. The second measure is a continuous variable representing straight-line distance in miles from the 1997 contour band. The value of this variable is zero at the contour line and it is positive when homes lie outside the noise contour band. I record negative values for this variable for homes than lie within the noise contour band. Thus, larger values of the distance variable indicate quieter locations. The mean value for this variable, 0.710, indicates that more homes lie outside the noise contour band than on the severe-noise side. Despite the FAA and HUD's definition of average noise levels in excess of 65 db as incompatible with residential housing, 21.7 percent of the home sales lie within the 1997 noise contour band, and homes lie as far as 1.5 miles within the contour band.

The basic equation for a standard hedonic model of house price is $y_i = \beta' X_i + \delta' D_i + u_i$, where y_i is the natural logarithm of the sales price of home i, X_i is a vector of house characteristics such as square footage and lot size, D_i is a vector of dummy variables indicating the date of sale, and u_i is an error term. I supplement this standard model with two measures of airport noise—*NOISE97*, a dummy variable that equals one when a home is located within the 1997 noise contour band; and the continuous measure of distance from the noise contour band, *DCONTOUR*. I then estimate the following two equations:

Model 1: $y_i = \beta' X_i + \delta' D_i + \gamma NOISE97 + u_i$.

Model 2: $y_i = \beta' X_i + \delta' D_i + \lambda DCONTOUR + u_i$.

Table 3 (p. 35) presents the regression results. All sales prices are in nominal terms; the year dummy variables adjust for inflation as well as real price increases. The key results are at the top of the table. Controlling for standard housing characteristics and other location variables, houses sell at a 10 percent discount when they are located within the 1997 noise contour band. Alternatively, the second regression indicates that each additional mile from the noise contour line increases home values by 8 percent. The t-values indicate that these discounts are highly significant. The discounts are at the high end of existing studies—not a surprising result given how intensively O'Hare is used.[5] Not only are average noise levels high around O'Hare, they are nearly unrelenting (at least in the daytime) because the airport has long operated at or near capacity levels.

Other results are standard. For example, an additional 10 percent of building square footage increases sales prices by about 36 percent, and prices rise by about 18 percent with an additional 10 percent of land area. However, these variables simply serve as controls for the purpose of this analysis. The coefficients for the years of sale are more important because they produce a constant-quality price index. Prices rose by 2.9 percent between 1996 and 1997 and by another 4 percent during the following year. Prices rose especially rapidly between 1999 and 2001. By 2001, prices were a full 34.2 percent higher than in 1996, or an average annual appreciation rate of 5.9 percent.

TABLE 2

Descriptive statistics

	Mean	Standard deviation	Minimum	Maximum
Sale price nominal dollars	186,637.800	76,163.790	10,000	1,380,000
Within 1997 noise contour	0.217	0.413	0	1
Within 2000 noise contour	0.113	0.317	0	1
Within long-range noise contour	0.052	0.222	0	1
Distance from 1997 noise contour	0.710	0.816	–1.501	2.000
Distance from Chicago CBD	14.304	3.839	8.683	23.995
Distance from O'Hare entrance	5.045	1.329	1.444	8.739
Distance from El stop	3.126	1.795	0.083	8.800
Distance from highway interchange	1.519	0.727	0.057	3.590
Distance from commuter train station	1.136	0.638	0.037	4.104
Within 1/8 mile of train line	0.085	0.279	0	1
Building area (sq. ft.)	1307.310	450.670	400	5644
Land area (sq. ft.)	6401.150	3705.199	536	195279
Age	45.842	17.484	1	128
Number of bedrooms	3.002	0.735	1	7
More than one story	0.348	0.476	0	1
Multi-level	0.072	0.259	0	1
Masonry construction	0.702	0.457	0	1
Slab foundation	0.108	0.310	0	1
Partial basement	0.208	0.406	0	1
Crawlspace	0.091	0.287	0	1
Basement is finished	0.277	0.448	0	1
Attic	0.405	0.491	0	1
Attic is finished	0.136	0.343	0	1
Central air conditioning	0.364	0.481	0	1
One car garage	0.337	0.473	0	1
Two or more car garage	0.525	0.499	0	1
Garage is attached	0.259	0.438	0	1
Fireplace	0.180	0.385	0	1
2000 Census median income (000s)	54.861	10.943	16.250	96.006
Within Chicago city limits	0.272	0.445	0	1
1996 sale	0.179	0.384	0	1
1997 sale	0.179	0.383	0	1
1998 sale	0.199	0.399	0	1
1999 sale	0.214	0.410	0	1
2000 sale	0.150	0.357	0	1
2001 sale	0.078	0.269	0	1

Note: The sample includes 22,541 single-family homes that are in Cook County and within two miles of the 1997 noise contour.
Source: Calculations based on Illinois Department of Revenue and Cook County Assessor data.

Predicted changes in home values

The reduction in noise around O'Hare Airport should make the area more attractive for homeowners. The area is well served by public transportation and is in the midst of a concentration of jobs that rivals Chicago's traditional business district in size and scope. Even after the proposed expansion, more homes are predicted to change from the severe-noise to the quiet side of the noise contour than vice versa. Data for 1997 from the Cook County Assessor's Office allow us to make tentative predictions regarding the change in home values over time. This dataset allows us to base our predictions on an entire census of homes in the area rather than on the subsample of sales.

Calculations using the 1997 data from the assessor's office imply that the average market value was $174,883 for the 13,311 homes that switched from the severe-noise side of the 1997 noise contour to the quieter side of the 2000 contour.[6] In contrast, the average market value was $113,306 for the 1,167 homes that switched from the quieter side of the 1997 noise contour to the severe-noise side of the 2000 contour. Based on this estimate, we would expect the average home price to increase by $17,488 in the area that switched from the severe-noise side of the 1997 noise contour

TABLE 3

Regression results for sales of single-family homes

	Coefficient	T-value	Coefficient	T-value
Within 1997 noise contour	–0.100	–22.798		
Distance from 1997 noise contour			0.080	25.509
Distance from Chicago CBD	0.025	25.018	0.025	25.185
Distance from O'Hare entrance	–0.025	–16.893	–0.044	–24.085
Distance from El stop	–0.085	–38.499	–0.085	–38.258
Distance from highway interchange	0.058	24.136	0.045	17.785
Distance from commuter train station	0.026	9.816	0.028	10.827
Within 1/8 mile of train line	–0.073	–15.072	–0.069	–14.263
Log of building area	0.367	49.543	0.356	47.934
Log of land area	0.183	45.036	0.186	45.859
Age	–0.002	–19.250	–0.002	–21.395
Number of bedrooms	0.027	10.210	0.028	10.696
More than one story	–0.027	–7.711	–0.024	–7.015
Multi-level	0.081	12.661	0.078	12.196
Masonry construction	0.007	2.014	0.002	0.690
Slab foundation	–0.062	–13.275	–0.058	–12.411
Partial basement	–0.047	–11.658	–0.048	–12.049
Crawlspace	–0.150	–28.415	–0.143	–27.001
Basement is finished	0.004	1.136	0.003	0.888
Attic	0.003	0.818	0.003	1.051
Attic is finished	–0.030	–6.121	–0.028	–5.803
Central air conditioning	0.014	4.525	0.012	3.928
One car garage	0.017	3.856	0.024	5.354
Two or more car garage	0.059	13.709	0.068	15.801
Garage is attached	0.024	6.149	0.024	6.012
Fireplace	0.093	23.045	0.092	22.861
2000 Census median income (000s)	0.007	47.443	0.007	46.866
Within Chicago city limits	0.160	37.940	0.160	38.121
1997 sale	0.029	6.672	0.029	6.585
1998 sale	0.069	16.206	0.068	16.036
1999 sale	0.135	32.365	0.134	32.347
2000 sale	0.249	54.811	0.249	54.857
2001 sale	0.342	61.399	0.343	61.693
Constant	7.428	60.092	7.338	135.123
R^2	0.689		0.690	

Notes: The dependent variable is the natural logarithm of the sales price. The number of observations is 22,541.
Source: Calculations based on Illinois Department of Revenue and Cook County Assessor data.

to the quieter side of the 2000 contour. Similarly, the average decline in home prices in the other area experiencing a change in noise contour would be $11,331. On net, the total value of homes in the area would increase by $219.6 million.

Home values should continue to increase even after the expansion since the trend toward quieter aircraft is continuing. The 4,079 homes in locations that are predicted to change from the quieter side of the 2000 noise contour to the severe-noise side of the post-expansion contour had an average value of $200,862 in 1997. More homes are predicted to switch from the severe-noise to the quiet side—9,889 homes, with an average value of $143,043 in 1997. Our 10 percent noise discount implies that the estimated net increase in home values between 2000 and the time after the expansion is $59.5 million. In addition to the change between 1997 and 2000, I estimate that aggregate home values will increase by nearly $280 million (in 1997 dollars) between 1997 and the time after the expansion of the airport.

These predictions are based solely on changes in noise contour status. The value of other homes may also increase, as nearly the entire area around O'Hare is experiencing reductions in aircraft noise. The predictions do not take into account other changes in the area affecting home prices. For example, Brueckner (2003) estimates that the O'Hare expansion would raise service-related employment in the Chicago area by 185,000 jobs. Some of these workers would move into the area around the airport, driving prices up further.

The crucial result is the counter-intuitive prediction that declines in aircraft noise can lead to increases in home prices even as the number of flights rises by nearly 60 percent.

Noise contour changes and home prices, 1996–2001

Three critical assumptions underlie the prediction that home prices will rise over time in areas experiencing reductions in aircraft noise. First, the noise contour maps must be accurate, including the one representing the time after the proposed expansion. Second, noise reductions must be generally known and understood so that they can be capitalized into home prices. Third, my predictions do not take into account uncertainty regarding future noise levels.

The proposed expansion plans create an enormous amount of uncertainty. Small changes in flight paths can produce large variations in noise levels. The densely populated area to the east of the airport lies under the expected landing patterns for the reconfigured runways. Quieter aircraft can still lead to noisier neighborhoods for homes lying under the paths of thousands of new flights. Uncertainty may well work to keep home prices from rising even in the short term, during which surrounding areas are clearly becoming quieter.

The Illinois Department of Revenue data allow me to test whether home prices have in fact appreciated more rapidly in areas that became quieter between 1997 and 2000. As model 1 is the standard for the literature, I use it as the basis for a model in which the noise discounts are allowed to vary over time and depend on the change in the contour status between 1997 and 2000. In the base location, a house is on the quiet side of the noise contour in both 1997 and 2000. Alternatives are to be 1) located on the quiet side of the noise contour in 1997 and the severe-noise side in 2000, 2) located on the noisy side of the 1997 contour and the quiet side of the contour in 2000, and 3) located on the severe-noise side of the contour in both years. These locations define three dummy variables showing the change in noise contour status between 1997 and 2000. Letting C denote this vector of dummy variables, the final estimating equation is

Model 3: $y_i = \beta' X_i + \delta' D_i + \gamma' C_i + \lambda' C_i \times D_i + u_i$,

where $C \times D$ represents the set of dummy variables obtained by interacting the time of sale variables with the variables representing changes in noise contour status. This flexible specification permits the appreciation rates to vary by both year and region.

Table 4 shows the results for time and noise contour status. Although the full model also includes the other variables listed in table 3, these results do not change substantially. The coefficients for year of sale indicate that the sale price of a home that is on the quiet side of the contour in both 1997 and 2000 increased by 3 percent between 1996 and 1997, by 7 percent between 1996 and 1998, and by 34.7 percent between 1996 and 2001. These appreciation rates are virtually identical to the results reported in the simpler, table 3 specification.

The coefficients for the noise contour status dummy variables are listed next in table 4. They show the discount (or premium) associated with sites in different regions. The insignificant t-value of 1.444 for sites that were on the quieter side of the 1997 contour and the severe-noise side of the 2000 contour indicates that there is not a significant difference between prices in this area and the base, quiet-quiet region. In contrast, homes that were on the severe-noise side of the boundary in 1997 sell at an 8.3 percent to 8.8 percent discount, compared with homes that were on the quiet side of the boundary in 1997. This discount is approximately the same for homes that fall on either the severe-noise or quieter side of the 2000 boundary.

The remaining variables show differences in appreciation rates over time. Accepting the estimates at face value, a property that was on the quieter side of the 1997 contour and the severe-noise side of the 2000 contour appreciated by only 3% – 2.4% = 0.6% between 1996 and 1997 and by 34.7% – 4.6% = 30.1% between 1996 and 2001. However, none of these coefficients is significantly different from zero, which implies that the appreciation rates for homes in this region are statistically no different from rates for homes that are on the quieter side of the boundary in both 1997 and 2000.

There is some evidence that homes on the severe-noise side of the boundary in 1997 appreciated somewhat less rapidly than homes that started on the quieter side of the boundary. The statistically significant coefficient for a 2000 sale of a property that changed from the severe-noise side of the 1997 boundary to the quieter side of the 2000 boundary indicates that the appreciation rate was 3.1 percent lower (22.7 percent versus 25.8 percent) than the base, quiet-quiet region. However, the appreciation rates are not significantly different for this noise-quiet region in any other year. The one-time difference in appreciation rates disappears by the following year: The difference in appreciation rates between 1996 and 2001 for homes in the noise-quiet and quiet-quiet regions is not statistically significant. The price path is similar for homes

TABLE 4

Regression results for changes in noise contour status

	Coefficient	T-value
1997 sale	0.030	6.066
1998 sale	0.070	14.629
1999 sale	0.140	29.573
2000 sale	0.258	49.803
2001 sale	0.347	54.460
Quiet side in 1997, noisy side in 2000	0.043	1.444
Noisy side in 1997, quiet side in 2000	–0.088	–8.759
Noisy side in 1997, noisy side in 2000	–0.083	–7.582
1997 sale, Quiet side in 1997, noisy side in 2000	–0.024	–0.523
1998 sale, Quiet side in 1997, noisy side in 2000	–0.016	–0.385
1999 sale, Quiet side in 1997, noisy side in 2000	–0.017	–0.420
2000 sale, Quiet side in 1997, noisy side in 2000	–0.036	–0.767
2001 sale, Quiet side in 1997, noisy side in 2000	–0.046	–0.877
1997 sale, Noisy side in 1997, quiet side in 2000	–0.005	–0.349
1998 sale, Noisy side in 1997, quiet side in 2000	0.005	0.376
1999 sale, Noisy side in 1997, quiet side in 2000	–0.018	–1.364
2000 sale, Noisy side in 1997, quiet side in 2000	–0.031	–2.171
2001 sale, Noisy side in 1997, quiet side in 2000	–0.016	–0.955
1997 sale, Noisy side in 1997, noisy side in 2000	–0.002	–0.107
1998 sale, Noisy side in 1997, noisy side in 2000	–0.021	–1.493
1999 sale, Noisy side in 1997, noisy side in 2000	–0.030	–2.197
2000 sale, Noisy side in 1997, noisy side in 2000	–0.043	–2.860
2001 sale, Noisy side in 1997, noisy side in 2000	–0.027	–1.472
R^2, number of observations	0.689	22,541

Notes: The dependent variable is the natural logarithm of the sales price. The full regression includes the explanatory variables listed in table 3.

Source: Calculations based on Illinois Department of Revenue and Cook County Assessor data.

that were on the severe-noise side of the boundary in both 1997 in 2000: Appreciation rates are lower by 3 percent in 1999 and 4.3 percent in 2000, but there is no significant difference in the rate of appreciation for the full 1996–2001 period for any of the regions.

Figure 4 shows the price paths implied by the results presented in table 4. Prices clearly are lower throughout this time for homes that start on the severe-noise side of the 1997 boundary. But the price paths are almost parallel. There is no evidence that prices appreciate more rapidly for homes that change from the severe-noise to the quiet side of the noise contour bands.

Although these results might simply indicate that homeowners are unaware of the noise reductions, a more likely explanation is that appreciation rates will not rise significantly near the airport as long as uncertainty looms regarding the expansion plans. The number of flights could increase from 928,000 to 1.6 million. Homes located in areas that currently are experiencing noise reductions could be faced with large increases in noise levels in the future. As long as the well-publicized expansion plans are cloaked in uncertainty, it is not surprising that prices are not appreciating unusually rapidly near the airport. Nevertheless, noise reductions should eventually result in higher appreciation rates, as neighborhoods near the airport become more attractive places to live.

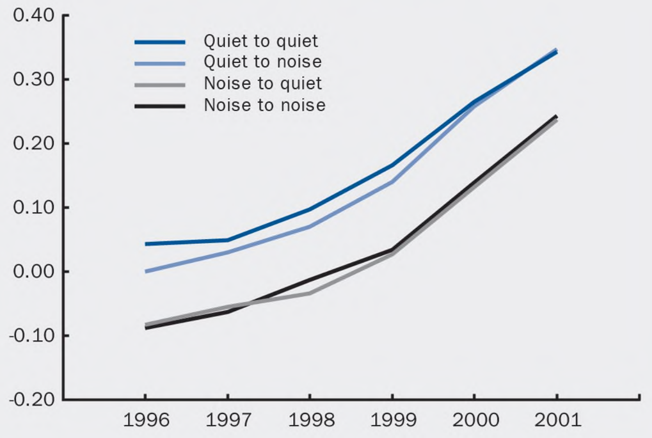
Conclusion

Empirical studies uniformly find that aircraft noise significantly reduces home prices. The area around Chicago O'Hare is no exception to this rule. Using transactions data for 1996–2001, I find that homes inside a 65-db noise contour band sell at a 10 percent discount relative to homes in quieter locations. Each additional mile from the noise contour band raises property values by 8 percent. In 1997, nearly 25,000 homes were located within the 65-db noise contour band, despite the fact that the FAA and HUD consider these noise levels to be inconsistent with residential housing.

As older aircraft are retired and airlines switch to smaller aircraft, residential neighborhoods near airports are becoming significantly quieter. The area within the 65-db contour band around O'Hare Airport fell from 57 square miles in 1997 to 38 square miles in 2000. More than 13,000 homes that were on

FIGURE 4

Estimated price indexes



the severe-noise side of the contour are now on the quieter side. Only 1,167 homes were in areas that changed from the quiet side to the severe-noise side. Aggregate home values can be expected to increase significantly as the area becomes more attractive for residential housing. My estimates imply that home values will increase by nearly $280 million (in 1997 dollars) between 1997 and the time after the expansion of the airport.

The regression models suggest that home prices did not appreciate any more rapidly in areas that were formerly on the noisy side of the noise contour line. All homes in the area around O'Hare Airport appreciated by about 34 percent between 1996 and 2001—an average annual appreciation rate of 5.9 percent.

Reductions in airport noise do not yet appear to be capitalized into property values. Homes that were in severe-noise areas in 1997 sold for the same discount in 2001 as in earlier years.

It is unlikely that homeowners and potential buyers are unaware of reductions in very loud and very obtrusive aircraft noise. A more likely explanation for the parallel price paths is that uncertainty concerning potential expansion plans for O'Hare Airport keeps prices from appreciating rapidly in areas that are becoming quieter. Plans call for the addition of one runway, along with major reconfiguring of the existing runways. Together, these changes could lead to nearly 700,000 additional flights at O'Hare each year, an increase of nearly 60 percent over current volumes. Despite this enormous increase in traffic, the area covered by the 65-db noise contour band is projected to decline still further to 27 square miles. If the projections are correct, home values may continue to rise even in the face of higher air traffic at O'Hare.

However, small changes in flight paths can affect many households, and homeowners may well be skeptical that such a large increase in the number of flights will not actually increase noise levels. Further, homeowners may dislike greater flight frequency even when average noise levels are the same. Faced with this uncertainty, it is not surprising that home prices have not appreciated unusually rapidly in areas that have experienced reductions in noise levels.

NOTES

[1]The source for the earlier load factor is the Metropolitan Planning Council (1996a). The source for current load factors and current and projected commercial passengers is the FAA website, http://apo.faa.gov/foreca03/actable10.xls.

[2]The source for these figures is the Bureau of Transportation Statistics: http://www.transtats.bts.gov/HomeDrillChart.asp?URL_SelectMonth=2&URL_SelectYear=2004.

[3]Metropolitan Planning Council (1996b).

[4]The history of the controversy is described in Martin and Cohen (2000).

[5]These results are robust. Other specifications that include nonlinear effects for the distance variables, distance to the CBD, the entrance to the airport, train stops, and highway interchanges all produce statistically significant noise discounts that are at the high end of the range of existing estimates.

[6]The assessor's data show assessed value rather than market value. Although the statutory assessment rate is 16 percent, on average homes in this area were assessed at 9.4 percent of market value in 1997. I divide assessed values by 9.4 percent to estimate market values.

REFERENCES

Bartik, T. J., and V. K. Smith, 1987, "Urban amenities and public policy," in *Handbook of Regional and Urban Economics, Vol. 2*, E. S. Mills (ed.), Amsterdam: North-Holland, pp. 1207–1254.

Black, S. E., 1999, "Do better schools matter? Parental valuation of elementary education," *Quarterly Journal of Economics*, Vol. 114, pp. 577–599.

Brueckner, J. K., 2003, "Airline traffic and urban economic development," *Urban Studies*, Vol. 40, pp. 235–248.

Collins, A., and A. Evans, 1994, "Aircraft noise and property values," *Journal of Transport Economics and Policy*, Vol. 28, pp. 175–197.

Espey, M., and H. Lopez, 2000, "The impact of airport noise and proximity on residential property values," *Growth and Change*, Vol. 31, pp. 408–419.

Feitelson, E. I., R. E. Hurd, and R. R. Mudge, 1996, "The impact of airport noise on willingness to pay for residences," *Transportation Research Part D*, Vol. 1, pp. 1–14.

Levesque, T. J., 1994, "Modeling the effects of airport noise on residential housing markets: A case study of Winnipeg International Airport," *Journal of Transport Economics and Policy*, Vol. 28, pp. 199–210.

Martin, Andrew, and Laurie Cohen, 2000, "Politics snarl O'Hare," *Chicago Tribune*, November 21.

McMillen, D. P., 2004, "Airport expansions and property values: The case of Chicago O'Hare Airport," *Journal of Urban Economics*, Vol. 55, pp. 627–640.

Metropolitan Planning Council, 1996a, "Airport capacity: A national perspective," aviation fact sheet, No. 3, April.

__________, 1996b, "Regional benefits of aviation," aviation fact sheet, No. 1, April.

Nelson, J. P., 1980, "Airports and property values: A survey of recent evidence," *Journal of Transport Economics and Policy*, Vol.14, pp. 37–51.

O'Byrne, P. H., J. P. Nelson, and J. J. Seneca, 1985, "Housing values, census estimates, disequilibrium, and the environmental cost of airport noise: A case study of Atlanta," *Journal of Environmental Economics and Management*, Vol.12, pp. 169–178.

Pennington, G., N. Topham, and R. Ward, 1990, "Aircraft noise and residential property values adjacent to Manchester International Airport," *Journal of Transport Economics and Policy*, Vol. 24, pp. 49–59.

Polinsky, A. M., and S. Shavell, 1976, "Amenities and property values in a model of an urban area," *Journal of Public Economics*, Vol. 5, pp.119–130.

Sheppard, S., 1999, "Hedonic analysis of housing markets," in *Handbook of Regional and Urban Economics, Vol. 3*, P. Cheshire and E. S. Mills (eds.), Amsterdam: North-Holland, pp. 1595–1635.

Theebe, M. A. J., 2004, "Planes, trains, and automobiles: The impact of traffic noise on house prices," *Journal of Real Estate Finance and Economics*, Vol. 28, pp. 209–234.

Tomkins, J., N. Topham, J. Twomey, and R. Ward, 1998, "Noise versus access: The impact of an airport in an urban property market," *Urban Studies*, Vol. 35, pp. 243–258.

Uyeno, D., S. W. Hamilton, and A. J. G. Biggs, 1993, "Density of residential land use and the impact of airport noise," *Journal of Transport Economics and Policy*, Vol. 27, pp. 3–18.

Zabel, J. E., and K. A. Kiel, 2000, "Estimating the demand for air quality in four U.S. cities," *Land Economics*, Vol. 76, pp. 174–194.

You can't take it with you: Asset run-down at the end of the life cycle

Kate Anderson, Eric French, and Tina Lam

Introduction and summary

The life-cycle model is the workhorse of most analyses of saving and is widely used to evaluate the macroeconomic and distributional effects of various policy proposals such as the repeal of estate taxation.

The life-cycle model presumes that people are forward-looking and make their current consumption and savings decisions based on their preferences for consumption and knowledge of their future income. In its simplest form, the model assumes that individuals know with perfect certainty the age at which they will die. Moreover, this simplest model assumes that individuals do not value inheritances to their children. That is, they have no bequest motive. Under this model, all individuals die with no wealth, because if an individual were about to die and had no bequest motive, he would be better off consuming all of his remaining wealth than if he died with some wealth remaining. Making a few additional assumptions about individuals' expectations of the future and their preferences[1] allows us to predict an individual's consumption and, thus, wealth at each age.[2]

Although this simple version of the life-cycle model is unrealistic, it is also simple to analyze. As a result, it is often used to evaluate policy reforms (Altig et al., 1997). However, this simple version of the life-cycle model is unable to replicate several key facts. Perhaps most importantly, empirical research shows that many households retain large amounts of assets even in old age (see Hurd, 1990, for a review).[3] Some have argued that the fact that many households do not run down their assets is evidence of a bequest motive, meaning that elderly people do not keep assets just for themselves, but also for their children.

Because most of the literature on policy reform relies on the simple life-cycle model, it has assumed saving behavior that compares poorly with the microeconomic data. It is possible that changing the assumptions of the simple life-cycle model to better describe the data will also change the results of the studies that use these models. Thus, a better understanding and quantitative analysis of household saving behavior may have a substantial impact on the evaluation of policy reforms, such as reforming the Social Security system, Medicare, and changing estate taxes.

To illustrate this point, we look at a policy issue where it is important to consider savings motives of individuals at the end of their lives: estate taxation. On July 7, 2001, the Economic Growth and Tax Relief Reconciliation Act was signed into law, which will gradually reduce estate taxation starting in the year 2002. The estate tax is a tax on assets that remain after an individual dies. The estate tax will be completely repealed in the year 2010.[4] Before the Economic Growth and Tax Relief Reconciliation Act was passed, only estates valued over $675,000 were taxed. By the year 2002, the exemption had risen to $1,000,000. Whether or not this reform increases or reduces gross domestic product (GDP) depends critically on the strength of the bequest motive. Therefore, whether we assume a bequest motive has a dramatic effect on the conclusions that we draw and the policy recommendations that we make. If, as in the simple life-cycle model, individuals have no bequest motive and, thus, do not value the estate they leave to their children, the estate tax will not affect the economic behavior of households.[5] The likely alternative to taxes on assets left after death is a tax on income while alive.

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In contrast to estate taxes, income taxes will likely reduce savings and work effort, which causes economic inefficiency, or "deadweight loss." It is likely that any loss of federal income due to a repeal of the estate taxes will force an increase in income taxes. Therefore, assuming that progressivity is a desirable feature in a tax system and distortions on work decisions and savings are undesirable, the repeal of the estate tax might be seen as undesirable; the decrease in estate taxes reduces progressivity, while the increase in the income tax distorts saving behavior.

On the other hand, if we move away from the simple life-cycle model, our conclusions may be different. If households have strong bequest motives, repealing the estate tax may have a non-trivial effect on saving decisions. (Castaneda et al., 2003, and Cagetti and DeNardi, 2003). For example, Cagetti and DeNardi (2003) find that eliminating the estate tax and replacing it with an increased labor income tax would raise GDP by .7 percent. Therefore, if bequest motives are very important, then the repeal of the estate tax is potentially a good idea.

In the above analysis, our conclusions differed dramatically depending on whether we used the simple life-cycle model or one that assumes a bequest motive. This indicates that understanding bequest motives is important to making policy decisions. An important first step for determining the strength of the bequest motive is to determine whether individuals decumulate or run down assets at the end of their lives. The absence of asset decumulation is potential evidence that bequest motives are important. The goal of this article is to provide new evidence on the extent to which households run down their assets near the end of the life cycle. Using data from Assets and Health Dynamics of the Oldest Old (AHEAD), we document asset growth at each age for members of different cohorts. This allows us to consider the quantitative importance of the asset decumulation puzzle.

There are several econometric problems with the existing evidence on asset run-down. We discuss these problems, as well as our approach to overcoming them. We find that whereas the usual approach for documenting asset run-down at the end of the life cycle shows some evidence of run-down, correcting for some important econometric problems removes almost all traces of asset run-down.

Asset run-down as predicted by the life-cycle model

In this section, we briefly describe the amount of asset run-down that we would expect to see if people behaved according to the life-cycle model. We calibrate a simple life-cycle model, as described in appendix A. Individuals in the model make consumption and saving decisions depending on their current assets, their perceived income and medical expenses in the future, how long they expect to live, and whether they have a bequest motive.

A model can not tell us what causes people to save. However, it can help us to frame the questions we need to ask in order to understand the causes of savings. A model that is calibrated to the data can also illuminate the likely causes of why individuals run down their assets so slowly. In this section, we provide evidence that uncertain life expectancy, uncertain medical expenses, and bequest motives are all potentially important savings incentives at the end of the life cycle.

We begin with the simplest version of the model, then move to more complex models. First, we present the case where individuals face no medical expense risk, have no bequest motive, and are certain to live 12 years, which is the average life expectancy for a man aged 70.

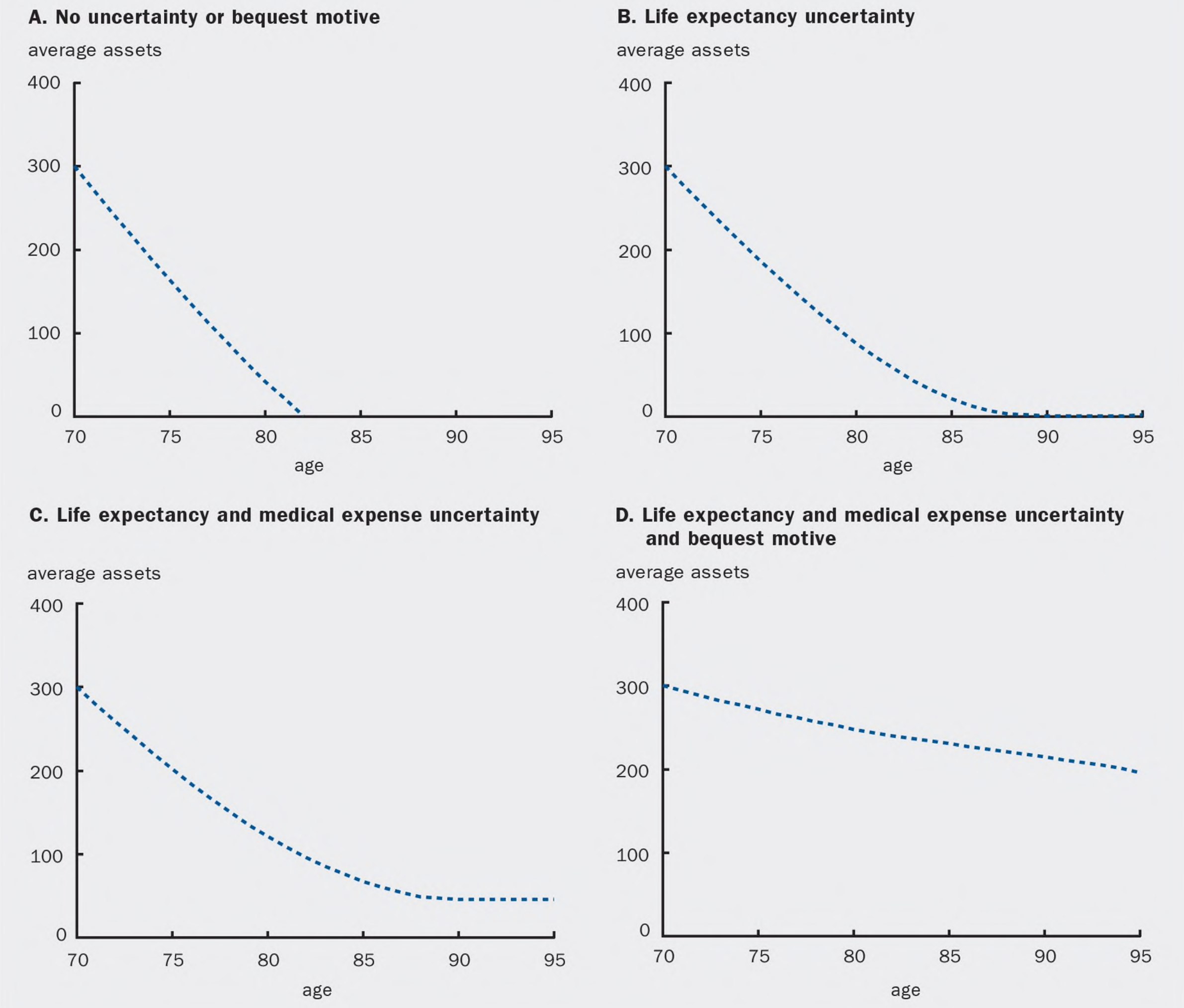
Panel A of figure 1 presents the asset profile implied by this model and highlights its key implication—Assets at age 82, the age of certain death, are equal to zero. This implication of the life-cycle model is at odds with the data, as we describe below.

Panel B of figure 1 presents the asset profile implied by a model augmented to include mortality risk. Life expectancy is still 12 years, but there exists the possibility of living much longer.[6] Panel B shows that individuals run down their assets much more slowly when the model is augmented to account for uncertain life expectancy. Because individuals are risk averse, they do not wish to outlive their financial resources. By holding assets until a very old age, they insure themselves against the risk of outliving their financial resources. Nevertheless, the model still predicts that by age 95, assets are near zero. Conditional on being age 70, there is only a 4 percent chance of surviving to age 95. Moreover, two annual mortality rates exceed 20 percent by age 95. Therefore, this model predicts that individuals would bear the risk of low consumption at age 95 in the event that they survive to that age. However, as we show below, this does not fit what is actually observed; many people still hold considerable levels of assets, even at age 95. Therefore, it seems that uncertain life expectancy alone cannot explain the slow rate of asset decumulation we observe in the data.[7]

The risk of catastrophic out-of pocket medical expenses also helps explain the absence of asset run-down. Even in the presence of social insurance (Medicare and Medicaid), households still face potentially substantial out of-pocket medical expenses (see French

FIGURE 1

Asset profiles



and Jones, 2004b; Palumbo, 1999; and Feenberg and Skinner, 1994). Moreover, nursing home expenses are potentially large and virtually uninsurable. French and Jones (2004b) find that in any given year, 1 percent of all households incur a medical expense shock that costs $44,000 over their lifetimes and .1 percent of all households incur a medical expense shock that costs $125,000 over their lifetimes. The risk of incurring such expenses repeatedly could financially decimate a household; this could cause a household to keep a large amount of assets in order to buffer itself against the possibility of catastrophic medical expenses. Therefore, the risk of catastrophic medical expenses might generate precautionary savings on top of those accumulated against the risk of living a very long life. Panel C of figure 1 presents the asset profile implied by a model augmented to include medical expenses, as well as mortality risk. It shows that individuals run down their assets much more slowly when faced with medical expense risk. Nevertheless, they still run down their assets much more quickly than we see in the data.[8]

Lastly, panel D of figure 1 presents the asset profiles implied by a model augmented to include a bequest function, as well as medical expenses and mortality risk. Unsurprisingly, asset run-down at the end of the life cycle is even slower when we augment to the model to include a bequest function. In short, uncertain life expectancy, uncertain medical expenses, and bequest motives all potentially play a part in asset run-down. Therefore, while a relatively slow rate of asset run-down is not necessarily *evidence* of a bequest motive, it is consistent with a bequest motive.

Data

In order to estimate the extent of asset run-down, we use data from the Asset and Health Dynamics Among the Oldest Old (AHEAD) dataset. The AHEAD is a sample of non-institutionalized individuals, aged 70 or older in 1993. A total of 8,222 individuals in 6,047 households were interviewed for the AHEAD survey in 1993. These individuals were interviewed again in 1995, 1998, and 2000. The AHEAD data include a nationally representative core sample, as well as additional samples of blacks, Hispanics, and Florida residents.

The AHEAD has information on the value of housing and real estate, autos, liquid assets (which include money market accounts, savings accounts, and Treasury bills), IRAs (individual retirement accounts), Keogh plans, stocks, the value of a farm or business, mutual funds, bonds, and "other" assets and investment trusts less mortgages and other debts. However, we do not include pension and Social Security wealth in order to maintain comparability with other studies (for example, Hurd, 1989, and Attanasio and Hoynes, 2000).

There are two important problems with our asset data. The first is that the wealthy tend to underreport their wealth in virtually all household surveys (Davies and Shorrocks, 2000). This will lead us to understate asset levels at all ages. However, Juster et al. (1999) show that the wealth distribution of the AHEAD matches up well with aggregate values for all but the richest 1 percent of households. A second important problem with our data is that it spans the years 1993 to 2000, a period in which there was a rapid rise in asset prices. This makes it difficult for us to distinguish between intended asset growth through active saving versus unintended asset growth though unexpectedly high asset returns.

There are also several econometric problems common to all panel data. Perhaps most importantly, the panel data suffer from attrition. In other words, people leave the sample over time. Interviewers make serious efforts to repeatedly interview the same individuals over time, but they are not always successful. There are many reasons for attrition in panel data. In the AHEAD survey, attrition is largely due to death. This information is recorded, and reported deaths are confirmed using the National Death Index. However, in some cases, interviewers are unable to track down sample members as they move homes, and some individuals refuse to give interviews.

This attrition raises two problems. First, those who leave the sample may be different from those who remain in the sample for systematic reasons. For example, wealthy individuals may not wish to report their wealth and refuse to be interviewed. Second, it is difficult to know whether an individual who leaves the sample is still alive. Individuals who cannot be contacted may have moved, but they also may be dead. Once again, this will cause problems if the people who are difficult to contact differ systematically from those we are able to keep track of. If, for example, it is relatively difficult to track down poor individuals who die, then we will potentially understate mortality rates for relatively poor people. Nevertheless, we find that, of 5,992 households, representing 23,053 household-year observations, only 502 leave the survey for reasons other than death versus 1,930 who die during the survey period. Removing those who leave for reasons other than death leaves us with a sample of 5,490 households, representing 20,527 household-year observations. Therefore, we view attrition for reasons other than death as a minor problem.

Another problem with the data is that the questions changed and became more comprehensive as time went by. Moreover, as respondents developed greater trust in the survey, they appeared to become more willing to report truthfully. As a result, much of the increase in assets over time, especially between 1993 and 1995, should be viewed with some skepticism. Table 1 shows average reported assets in each wave, by type of asset. Note that both reported business wealth and stock market wealth more than double between 1993 and 1995. Although asset prices grew quickly over this time period (see figure 5 on p. 47), they averaged less than 15 percent growth per year. This makes the wave 1 values of stock and business wealth appear especially suspicious.

Life-cycle asset profiles in the cross-section

Given that most studies use cross-sectional data to estimate the life-cycle profile of assets, we begin by repeating this exercise. By initially replicating the results of other studies, we can infer whether our results differ from previous results because we use different data or because we use different estimation techniques. Figure 2 shows mean household assets, by five-year age groups of the head of household, starting with age 70–74 and ending at 90–94, from the 1993, 1995, 1998, and 2000 waves of the AHEAD.

There are several things that we can note from figure 2. First, later cross-sections show higher assets than earlier cross-sections at each age. For example, at age 75–79 the 1993 cross-section shows assets equal to $210,000, the 1995 cross-section shows assets equal to $290,000, the 1998 cross-section shows assets equal to $300,000, and the 2000 cross-section shows assets equal to $400,000. Second, figure 2 shows some evidence that assets decline with age in each

TABLE 1

Mean assets, by year and asset category

	1993	1995	1998	2000
Housing	$88,217	$94,092	$95,423	$114,559
Liquid assets	33,288	53,874	52,844	51,299
Stocks	22,012	53,496	55,870	67,485
Autos	6,634	5,759	5,726	6,646
Businesses	3,907	8,270	10,847	9,923
IRAs	6,491	9,046	11,397	12,532
Trusts	34,343	37,148	46,060	79,582
Other assets	2,404	4,086	5,044	4,752
Total debt	3,090	3,393	3,942	3,540
Total assets	194,207	262,378	279,269	343,239
Number of observations	4,694	4,174	3,318	2,704

cross-section. The 1993 asset profile shows assets declining from $240,000 at age 70–74 to $100,000 at age 90–94. Asset profiles for other years also show rapid declines in assets between ages 70 and 94.

Because the distribution of assets is skewed (that is, a small number of households have very high assets), mean assets can give a misleading depiction of the asset distribution at each age. Nevertheless, median and mean asset profiles have similar shapes. For example, in 1993 median assets were $110,000 for households aged 70–74 and only $30,000 for households aged 90–94. These results suggest that assets do decline with age. Recall, however, that those who are 90–94 in a given year were born 20 years earlier than those aged 70–74 in the same year, and thus had lower lifetime income.

In the past, cross-sectional data were used to infer life-cycle saving decisions because of a lack of data. Until recently, panel data on wealth were not available, so most analyses of the life cycle were based on single cross-sections by necessity (see Hurd, 1990, who mentions the rare exceptions). Below, we discuss some of the problems associated with using a cross-sectional profile to infer the evolution of wealth over the life cycle.

Estimation issues

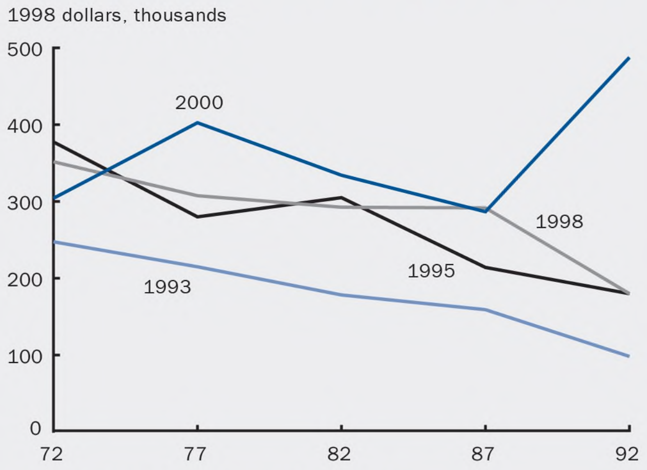
We estimate life-cycle asset profiles of households. However, there are three main problems with the estimation of life-cycle asset profiles. Below, we discuss these problems, as well as our approach to dealing with them.

First, in cross-sectional data we observe individuals who were born at different times (that is, older people were born in earlier years than younger people). Households from older cohorts have on average lower real lifetime earnings than households from younger cohorts. Thus, we would expect the asset levels of households in older cohorts to be lower than those of younger cohorts in any given year. Therefore, comparing older households with younger households leads the econometrician to overstate assets when young and to understate assets when old when looking at a particular year. In other words, this will potentially lead the econometrician to infer that individuals run down their assets near the end of their lives when this is not actually the case.

Figure 3 helps quantify this point. It shows the level of real per capita income in the United States over the 1950–2002 period. Income per capita is indexed to 100 in 1950. Figure 3 shows that in most years, income per capita increases, averaging 1.7 percent growth over the sample period. Therefore, two cohorts born

FIGURE 2

Mean assets, by wave and age of head of household



Sources: AHEAD data and authors' calculations.

20 years apart tend to have lifetime incomes that are different by a factor of $1.017^{20} = 1.40$. In other words, members of the cohort that were age 70–74 in 1993 are likely to have average lifetime incomes that are 40 percent higher than those of the cohort that were 90–94 in 1993.

A second econometric problem occurs because people with lower income and wealth tend to die at younger ages than richer people. Therefore, the average survivor in a cohort has higher assets than the average deceased member of the cohort. As a result, "mortality bias" leads the econometrician to overstate the average lifetime income of members of a cohort. This bias is more severe at older ages, when a greater share of the cohort members are dead. With cross-sectional data, the econometrician is forced to treat the level of assets of surviving (and, on average, higher-asset) members as indicative of the entire cohort, had all members survived. This leads the econometrician to increasingly overstate assets as individuals age.

One way to ascertain whether mortality bias will be an issue is to look at probability of death at each age, conditional on wealth. We made predictions by regressing an indicator for whether the respondent died on a polynomial in age, a polynomial in the respondent's percentile in the wealth distribution, and interactions of age and percentile in the wealth distribution. Figure 4 shows this statistic for women and men in our sample. It shows that, conditional upon age, those with low wealth are more likely to die than those with high wealth. For example, in our sample, the average probability of death for men at age 80 in 1993 is 8.0 percent.[9] However, the probability of death for men who are at the 80th percentile of the wealth distribution is 7.0 percent, whereas the probability of death for men whose wealth is at the 20th percentile of the wealth distribution is 10.1 percent. Conditional on being alive at age 70, life expectancy is 14.2 years at the 80th percentile of the wealth distribution and 11.5 years at the 20th percentile. These differences in mortality across wealth quartiles are smaller than differences reported in Attanasio and Hoynes (2000), who use data from the Survey of Income and Program Participation. They report that those in the bottom quartile of the wealth distribution have mortality rates over double the rates of those in the top quartile of the distribution.

We solve both of these problems by using panel data, which allows us to track the same households over time. Our profiles are estimated using the growth rate of assets for surviving households in different years. Because we are tracking the same households over time, we are obviously tracking members of the same cohort over time. Because we estimate growth rates for surviving households, our estimates do not suffer from mortality bias. Next, we detail these procedures.

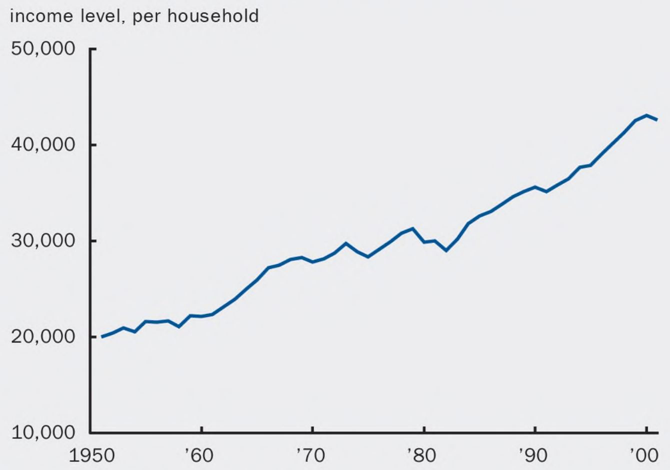
While tracking the same households over time solves the two problems discussed above, it also makes another more serious problem. Asset growth of a household not only represents anticipated asset growth through savings, but also unanticipated asset growth. Over our sample period, there are large shocks to the rate of return on savings, primarily due to the run-up in the stock market.

Figure 5 shows growth in the stock market. Specifically, it shows the dollar value of a broad portfolio of stocks invested in 1950 (as measured by the Center for Research in Security Prices data or CRSP). The CRSP stock market index measures the growth of a portfolio of stocks that includes all stocks in the NYSE, AMEX, and NASDAQ indices. It is a broader measure of stock prices than the S&P 500 or the Wilshire 5000 index. Figure 5 shows that stocks grew at a much faster rate over the 1993–2000 period than during the previous 40 years. For example, the CRSP index grew at an average annual rate of 14.9 percent over the 1993–2000 period, compared with only 9.4 percent over the 1950–92 period.

Figure 6 shows growth in the housing market, based on the dollar value of a home purchased in 1950. For growth

FIGURE 3

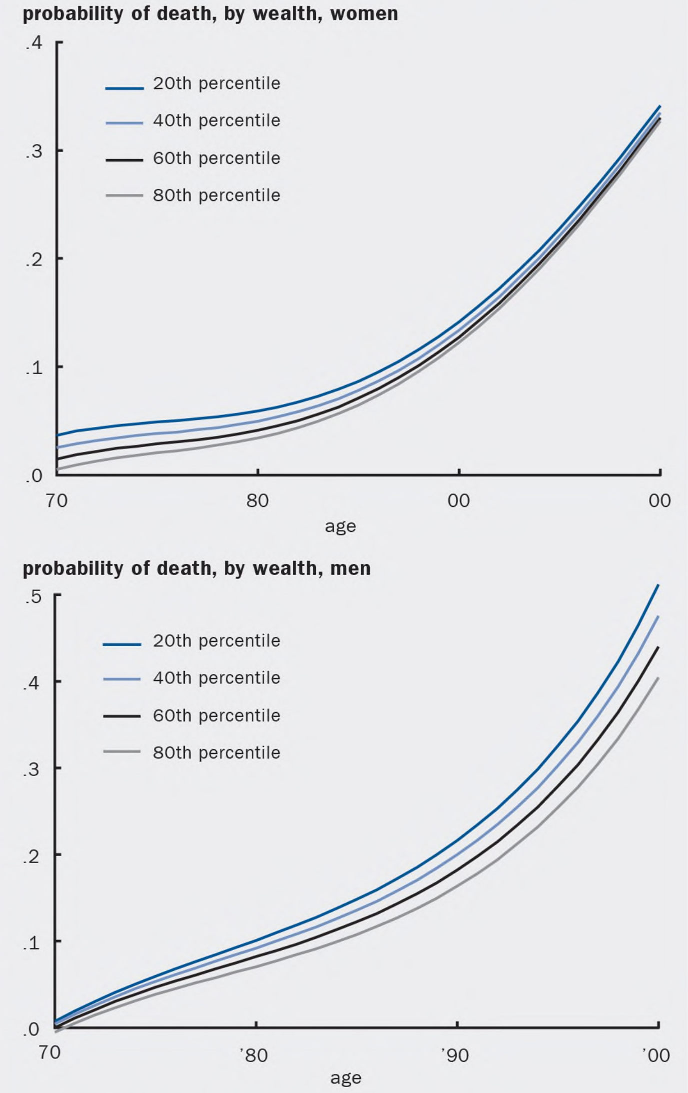
Real income per capita, 1950–2002



Source: U.S. Bureau of Labor Statistics data from Haver Analytics.

FIGURE 4

Mortality probabilities, by wealth quartile



Sources: AHEAD data and authors' calculations.

rates between 1950 and 1971, data are from the price index for private residential investment divided by the price index for all personal consumption expenditures, as measured in the National Income and Product accounts. For housing price growth after 1971, data are the price series from the Conventional Mortgage Home Price Index from the Office of Federal Housing Enterprise Oversight, which is a price index of single family homes.[10]

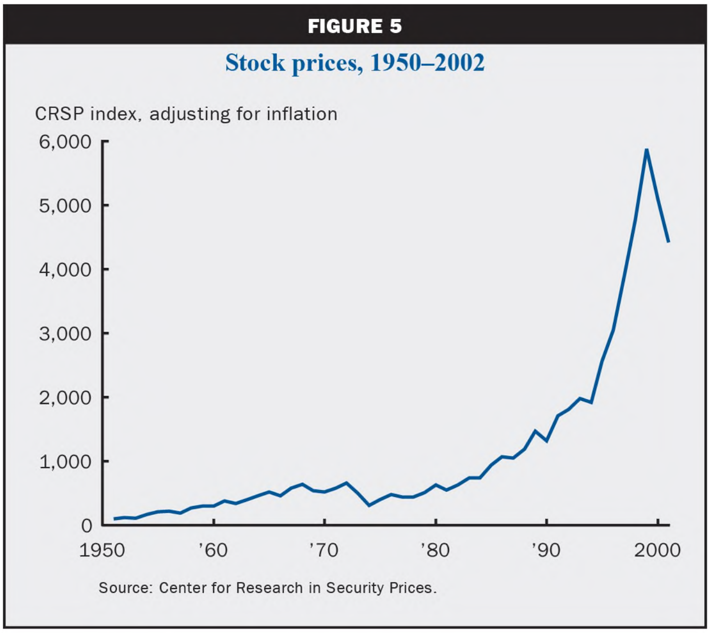
Figure 6 shows that housing prices grew much more rapidly over the 1993–2000 sample period than over the previous 40 years; prices grew 2.3 percent over the 1993–2000 period, versus .8 percent over the 1971–92 period.

Table 1 shows that in our AHEAD sample, 28 percent of household wealth is held in stocks, either directly or through IRAs (Cheng and French, 2000, find that 60 percent of all IRA wealth was held in stocks during our sample period and we assume that 50 percent of all wealth in trusts are in stock market wealth). Another 36 percent of wealth is held in housing. Much of the remainder of household wealth is held in assets that likely did not grow very much over the sample period, such as short-term bonds.

Life-cycle asset profiles

Panel A of figure 7 (p. 48) presents estimates of the life-cycle asset profile for five different five-year birth cohorts using both fixed-effects and ordinary least squares (OLS) (we detail our estimation methods in box 1 on p. 49). Consider the OLS estimates first. These life-cycle profiles are for the cohorts aged from 70–74 through 90–94 in 1993. Because the OLS estimator of assets at each age is merely the sample mean, it is unsurprising that the 1993 value of mean assets for each cohort reported in the panel A of figure 7 is roughly the same as the mean assets from the 1993 cross-section of assets reported in figure 2. Note that in 1993, mean household wealth was \$283,000 for those aged 70–74, \$230,000 for those 75–79, \$191,000 for those 80–84, \$163,000 for those 85–89, and \$100,000 for those 90–94. In other words, wealth of the oldest cohort was 64 percent lower than wealth of the youngest cohort in 1993. One could argue that this is evidence of asset run-down within households (Hurd, 1990). Recall, however, that households aged 90–94 in 1993 were born 20 years earlier than households aged 70–74 in 1993. If aggregate income grows 1.7 percent per year, then the lifetime income of the oldest cohort is 34 percent lower than for the youngest cohort. Therefore, the fact that the 1993 wealth level is 65 percent lower for the 90–94 cohort relative to the 70–75 cohort is evidence of only a minor run-down in assets.

When tracking assets of households within a cohort, note the rapid increases in assets over the length of the panel. For example, assets increase about 37



for the same households, it does not suffer from mortality bias.[12]

Although fixed-effects estimates indicate slower asset growth than OLS, they still show increases in assets with age, indicating that the same sample members had significant run-ups in assets during the sample period. The question remains, however, whether these run-ups in assets were anticipated. Because the sample period was 1993–2000 and the fixed-effects profiles track asset growth over the sample period, the fixed-effects profiles still suffer from mixing anticipated asset gains with unanticipated asset gains from the stock market, as mentioned earlier.

Additionally, the wealth profiles presented above mix the asset growth of different types of households. Panel B of figure 7 shows that for households with both a husband and a wife present in wave

percent between 1993 and 2000 for the cohort aged 70–74 in 1993. Although one could argue that this is evidence that wealthy households intentionally increase their wealth, recall that asset prices increased rapidly over the sample period. Recall that stock price growth was 7 percent above its average over the 1950–1992 period and housing price growth was 1.5 percent above its average for the 1971–1992 period. If individuals expected average asset price growth over the seven years of the 1993–2000 period, their stock market wealth would be (1.055)7 –1 = 45% higher than anticipated and their housing wealth would be (1.015)7 – 1 = 11% higher than anticipated.[11] Given that 28 percent of household wealth is held in stocks and 36 percent in housing, household wealth was approximately (.28 × .45 + .36 × .11) = 17% higher than anticipated. Therefore, much (but not all) of the apparent run-up in assets results from the run-up in asset prices.

Next, consider the fixed-effects profiles. Fixed-effects profiles show less asset growth with age. If no members of the sample left the survey for death or other reasons, OLS and fixed-effects would produce the same results as fixed effects. However, because sample members die, the two profiles are different, especially for the older cohorts with higher mortality rates. Because the fixed-effects estimator estimates asset growth

1 (that is, in 1993), asset growth was even more rapid than for the full sample. Panels C and D of figure 7 show that for single women and men in wave 1, respectively, there is very little evidence of asset run-up over the sample period. Hurd (1990) also finds more evidence of asset run-down by singles than couples.

There are three possible reasons the asset profiles of these three groups differ. First, asset compositions may be different across household types. However, the differences turn out to be fairly small. For example, both couples and single women have 23 percent of

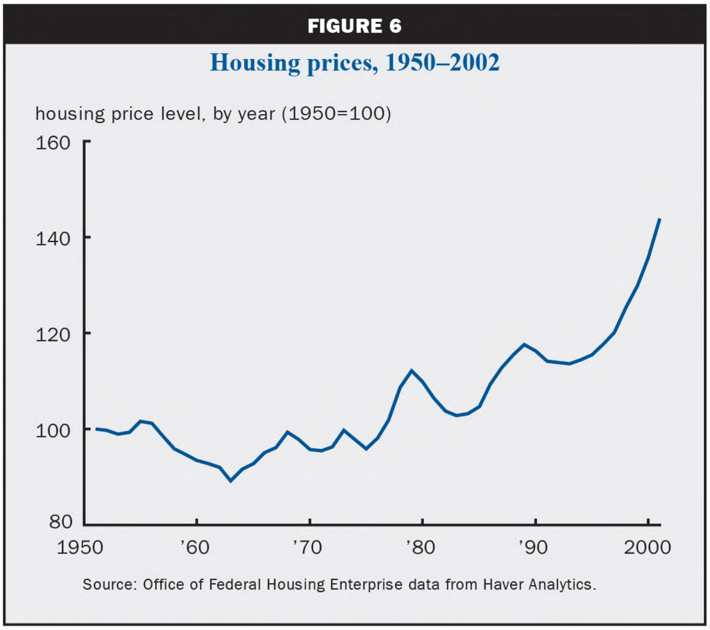
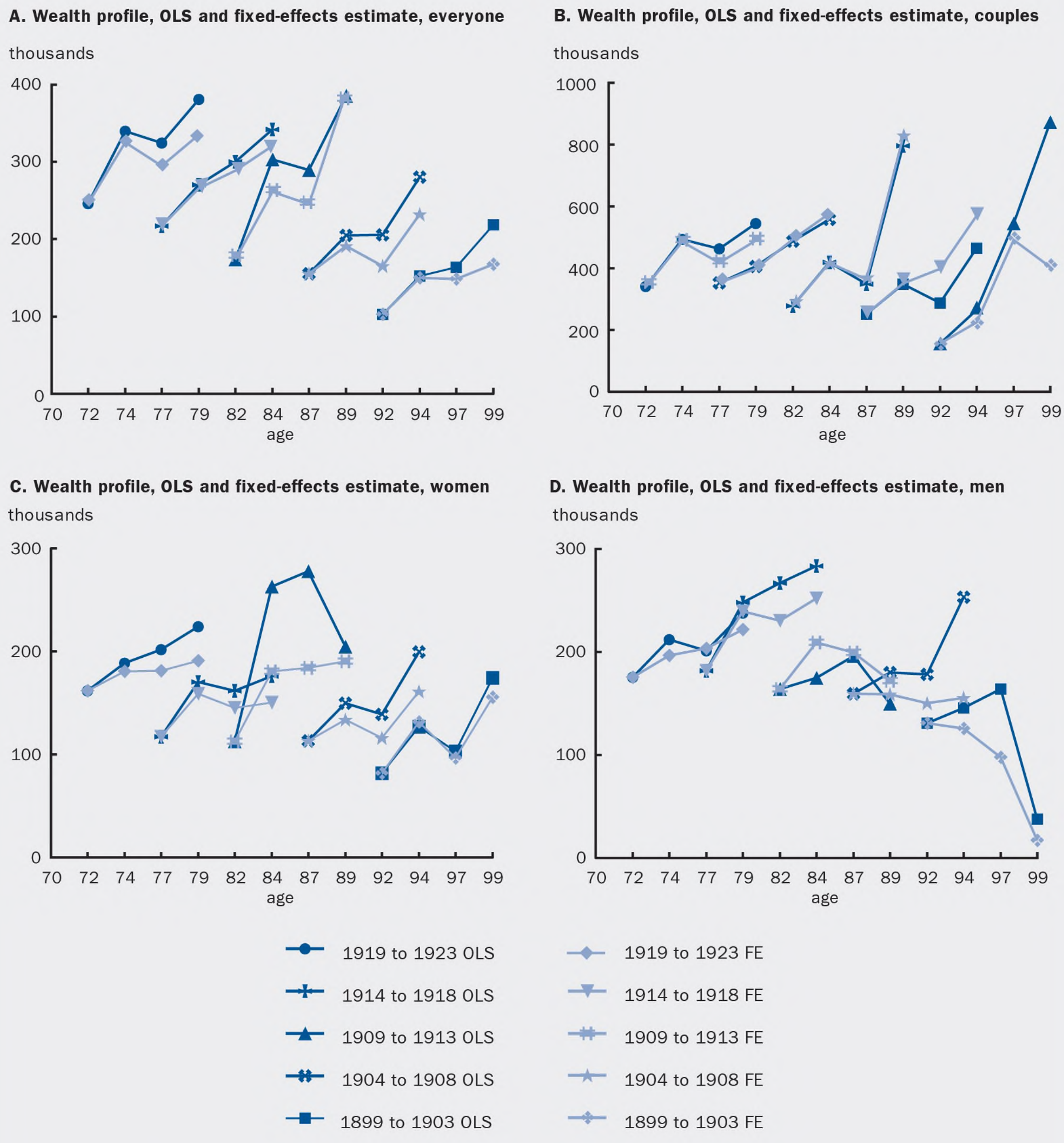


FIGURE 7

Average assets, by age and cohort



Sources: AHEAD data and authors' calculations.

their assets in stocks, and single men have 18 percent of their assets in stocks. Therefore, couples benefited only slightly more from the run-up in the stock market than did singles. A second possible explanation is that singles are less likely to have children than couples (although there are many singles who were previously married in our sample) and are less likely to have a strong bequest motive. Third, it may be that couples have stronger life-cycle savings motives than singles. Married individuals tend to live longer than singles. We leave a deeper understanding of these differences for future research.

BOX 1

Statistical methods

In the section, "Life-cycle asset profiles," we provide estimates of expected wealth at each age given that the individual was observed in the initial period. We do this using both OLS and fixed-effects estimators. This box discusses the difference between the two estimators. Specifically, we show that using fixed-effects estimators overcomes the mortality bias problem, where the OLS estimator does not.

Consider a set of individuals referenced by $i \in \{1, ..., I\}$ who were born in 1923 (in practice, we use five-year cohorts, one being born 1919–23). As we described earlier, we observe these individuals in 1993, 1995, 1998, and 2000. Therefore, we observe members of this cohort at age 70, 72, 75, and 77. We denote their age by $a \in \{70, 72, ..., A\}$, where $A = 77$. Assets of a particular individual at a certain age, denoted A_{ia}, are determined by the following function:

1) $$A_{ia} = f_i + \beta(a) + u_{ia},$$

where f_i is the individual's fixed effect, which includes all age-invariant factors, u_{ia} is a residual, and $\beta(a)$ is a function of a. We wish to estimate the function $\beta(a)$ which measures how assets change as individuals age. The results from the section on asset run-down in the life-cycle model indicate that understanding $\beta(a)$ will help us better understand savings motives after retirement. We estimate the function using a full set of dummy variables, that is,

2) $$\beta(a) = \sum_{age=72}^{A} \beta_{age} \times 1\{a = age\},$$

where $\{\beta_{age}\}_{age=72}^{A}$ represents[1] a vector of parameters to estimate and the 0-1 indicator function $1\{.\}$ returns 1 when the statement in parentheses is true and returns 0 otherwise.

The fixed effect f_i and the residual u_{ia} merit further discussion. The fixed effect captures objects such as lifetime earnings. Individuals with high lifetime earnings likely have high wealth at every age.

The residual captures variation in wealth arising from short-term contingencies, such as medical expenses. It also captures the difference between the true level of assets and reported assets, that is, it is possibly measurement error.

We are interested in obtaining consistent estimates of the parameter vector $\{\beta_{age}\}$. However, OLS estimates of the regression

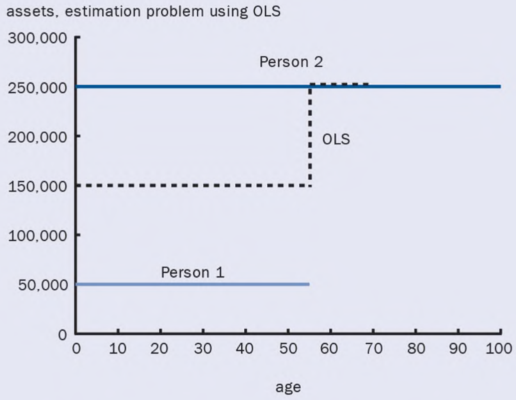
3) $$A_{ia} = f + \sum_{age=72} \beta_{age} \times 1\{a = age\} + e_{ia}$$

will not yield consistent estimates $\{\beta_{age}\}$.

To see the problem with OLS and how fixed effects circumvents this problem, consider figure B1. It shows wealth profiles of two households. The first household has \$250,000 in every year. The second household has \$50,000 in every year until death, at age T. In the notation above, $f_1 = \$250{,}000$, $f_2 = \$50{,}000$, $\beta_{age} = 0$ for all ages, and $u_{1a} = u_{2a} = 0$ for all ages.

FIGURE B1

OLS estimators



The OLS estimator estimates average assets at each age. When both households are alive, average assets are \$150,000. When only the wealthy household is alive (after age T), average assets are \$250,000. Therefore, the OLS estimator infers that average assets jump at age T. While assets did rise at this age, they did not rise for any individual.

The fixed-effects estimator, on the other hand, infers whether assets rise relative to the fixed effect (f_i). The fixed effects estimator correctly infers that assets do not rise at any age for individual i and thus $\beta_{age} = 0$ at all ages. We give a more technical discussion in appendix B.

[1]Because we have a fixed-effect for each household, the age 70 coefficient is captured in the intercept term f_i because the age 70 wealth level is just the average fixed effect for individuals age 70.

Conclusion

A key implication of the simplest version of the life-cycle model is that assets are run down as individuals near death. This article presents new evidence on the lack of asset run-down at the end of the life cycle. We show that assets decline with age when observing different individuals at different ages at a single point in time. However, the younger individuals in the sample, who were born more recently, are likely to have higher income and wealth at every age. When looking at a single point in time, this leads to an overstatement of wealth when young and thus overstates the extent to which assets decline with age. We also show that wealth rises with age when tracking the same individuals as they age. Because we track households over the 1993–2000 period, we observe individuals in 1993 and the same individuals seven years later, in 2000. Although we can measure the asset growth of the exact same people, we do not know whether assets grew because of intentional savings decisions or because of the run-up in the stock market over this period. We are partly able to resolve these discrepancies. When we make some simple adjustments, we find little evidence that people intend to either increase or decrease their assets near the end of their lives. We take this as evidence against the simplest versions of the life-cycle model. We also show that our results fit better with versions of the life-cycle model that are augmented to include life expectancy and medical expense uncertainty as well as bequest motives.

APPENDIX A: A MATHEMATICAL REPRESENTATION OF THE LIFE-CYCLE MODEL

In order to fix ideas about the life-cycle model, we discuss a parameterized mathematical model of how individuals consume and save over their lives. In figure 1 (p. 42), we show the implied consumption and wealth profiles for a given initial value of wealth and for income over the life cycle. As in the introduction, assume that there is no uncertainty about income, or medical expenses, although we will allow for uncertainty about age of death. The model is similar to that of Palumbo (1999), although it also allows for a bequest function, as in Hurd (1990).

Specifically, consider a household head seeking to maximize his expected lifetime utility at age $t = 70, 71, 72, \ldots$. Each period that he lives, the individual receives utility, U_t, from consumption, C_t. Furthermore, assume that his preferences are of the constant relative risk aversion form, so that $U_t = \frac{(C_t)^{1-\gamma}}{1-\gamma}$. The parameter γ is called the coefficient of relative risk aversion. The greater the value of γ, the more risk averse the individual. Most estimates of γ are between 1 and 5. A value of γ equal to 1 implies that an individual would be indifferent between consuming \$14,140 this year or consumption determined by the following lottery: with probability 1/2 consume \$10,000 this year and with probability 1/2 consume \$20,000. Note that this lottery has an expected payout of 1/2 × \$10,000 + 1/2 × \$20,000 = \$15,000. If the individual has a coefficient of relative risk aversion of 5, an individual would be indifferent between consuming \$11,700 this year or consumption determined by the lottery described above. In other words, the greater the value of γ, the greater the amount the individual is willing to pay to avoid the risk associated with a lottery.

When he dies, he values bequests of assets, A_t, according to a constant relative risk aversion bequest function $b(A_t) = \theta_B \frac{(C_t)^{1-\gamma}}{1-\gamma}$. The greater the value of θ_B, the stronger the bequest motive. We know very little about this parameter.

Let s_t denote the probability of being alive at age t conditional on being alive at age $t-1$, and let $S(j,t) = (1/s_t)\prod_{k=t}^{j} s_k$ denote the probability of living to age $j \geq t$, conditional on being alive at age t. Let $T = 95$ denote the terminal period, so that $s_{T+1} = 0$.

We assume that preferences take the form

$$4)\quad U(C_t) + E_t\left(\sum_{j=t+1}^{T+1} \beta^{j-t} S(j-1,t)\left[s_j U(C_j) + (1-s_j) b(A_j)\right]\right),$$

where E_t is an expectations operator and β is the time discount factor. The smaller the value of β, the more individuals discount the future relative to the present. Most estimates of β are between .95 and 1.

Furthermore, assume that individuals have the following asset accumulation equation:

$$5)\quad A_{t+1} = (1 + r)(A_t + Y_t - m_t - C_t),\ A_{t+1} \geq 0,$$

where r is the interest rate, Y_t is income, and m_t denotes medical expenses. Assets must always be non-negative in all periods.[1] In this article we present simulations from this model.

When presenting profiles implied by the model, we consider a value of γ equal to 3 and β equal to .95. Throughout the article, we assume that assets in the bank receive a 4 percent rate of interest. Initial assets at age 70 are \$300,000 (which is close to the mean for our sample), income at each age is \$20,000 (which is close to the mean in our sample).

[1]If the non-negativity constraint on assets implies consumption below \$5,000 (which is a conservative estimate of the SSI, housing, and Medicaid benefits the elderly can receive), we set consumption equal to \$5,000. See French and Jones (2004a) for more on this.

APPENDIX B: WHY OLS WILL NOT YIELD CONSISTENT ESTIMATES, BUT FIXED EFFECTS WILL: A TECHNICAL DISCUSSION

To understand why OLS is unlikely to produce consistent estimates, consider the "true" model in equations 1 and 2 as well as the OLS estimator in equation 3 (in box 1). Note that $e_{ia} = f_i + u_{ia} - f$. Recall that those with above average values of wealth (an above average value of f_i) are likely to live longer than average. As a result, $E[(f_i - f)1\{a = age\}] > 0$ for a large value of a (that is, at older ages), which will result in $\{\beta_{age}\}$ being biased upwards for a large value of a. We obtain consistent estimates of $\{\beta_{age}\}$ only if $E[e_{ia} \times 1\{a = age\}] = 0$.

By de-meaning the data, however, we can overcome this problem. Specifically, we estimate the regression:

$$6)\quad A_{ia} - \overline{A}_i = f_i - \overline{f}_i + \sum_{age} \beta_{age} \times 1\{a = age\} - \left[\overline{\sum_{age} \beta_{age} \times 1\{a = age\}}\right] + u_{ia} - \overline{u}_i ,$$

where $\overline{A}_i = \frac{1}{A}\sum A_{ia}$, $\overline{f}_i = \frac{1}{A}\sum f_i$, and so on. Note that $f_i - \overline{f}_i = 0$. If $E[u_{ia} \times 1\{a = age\}] = 0$, then $E\left(1\{a = age\} - \left[\overline{\sum_{age} \beta_{age} \times 1\{a = age\}}\right]\right)\left(u_{ia} - \overline{u}_i\right) = 0$, and we will obtain consistent estimates. We discuss the plausibility of this assumption in the text.

When predicting assets using the fixed effects estimator, we use the average fixed effect of the cohort members observed in 1970.

NOTES

[1]In the simplest life-cycle model, the assumptions are that individuals know their future income, medical expenses, and health status, and that individuals have constant relative risk aversion preferences.

[2]If individuals are certain of all future events, then whether consumption is increasing or decreasing over the life cycle depends on only two things: the discount rate and the rate of interest. First, if individuals are very impatient (have a high discount rate), then they will consume more in the present, less in the future. Second, if the market rate of interest is high, then individuals will have an incentive to save money, consuming less in the present, more in the future.

[3]There are several other facts that the simplest version of the life cycle cannot explain. For example, the distribution of wealth is much more skewed than the distribution of income (Díaz-Giménez et al., 1997). Also, the saving rate of people with higher lifetime income is much higher than the one of people with lower levels of lifetime income (Dynan et al., 1996).

[4]Under this law, the estate tax will be re-imposed in 2011.

[5]Assuming no bequest motive and uncertain mortality, and holding income taxes constant, repealing estate taxes might reduce savings levels and thus output. The intuition behind this is that children of the deceased might reduce savings rates given that they can finance retirement with assets that their parents leave behind to hedge against extended life. This would, in turn, reduce aggregate savings and thus capital.

[6]Survivor probabilities are taken from U.S. life tables.

[7]Hurd (1989) argues that uncertain life expectancy can explain the slow rate of asset run-down in his data from the Retirement History Survey.

[8]However, we found that medical expense risk could generate a large amount of savings for some parameter of the model. For example in results not reported, we found that the importance of medical expenses depends critically upon the extent to which the government provides insurance against catastrophic medical expenses through what we refer to as "consumption floors." Consumption floors are meant to capture social insurance schemes such as Medicaid, Supplemental Security Income (SSI), and food stamps. Results presented are for the case when we set the consumption floor to $5,000. Given that Medicaid covers virtually all medical expenses, and SSI provides income to individuals who have low income and assets, we believe that this is a conservative value for the consumption floor. For example, SSI benefits are $9,480 per year in California and $7,200 in Nevada. Nevertheless, lowering the consumption floor to $100 produces much higher savings rates. Also, higher levels of risk aversion produce higher levels of savings.

[9]In the life tables for the U.S., the corresponding probability of death at age 80 is 8.6 percent. This discrepancy is possibly due to the fact that the core sample in the AHEAD was not in a nursing home in 1993. Therefore, the AHEAD sample is healthier than the U.S. population.

[10]The main difference between the two measures is in the controls for the quality of the home. The quality of homes has changed over time as different amenities become available for homes. Some features on homes, such as intercom service, were not available 50 years ago. Therefore, comparing average home price from year to year provides a misleading picture of housing price appreciation. The price index for private residential investment measures the price of new homes. Adjustments for changes in the quality of new homes is made using a hedonic adjustment. The other index is constructed using resale prices of the exact same homes whose mortgages are held or guaranteed by Fannie Mae or Freddie Mac. Although this approach overcomes the problems associated with hedonics, the approach still has problems. Most importantly, the approach does not account for home improvements. Moreover, these indices are available only back to 1971.

[11]This is assuming that the run-up in assets did not affect savings behavior.

[12]Shortly before death, assets may decline because of high medical expenses. Because of this, we may miss significant asset declines if they take place between the time that the individual is last interviewed and the date of death. This potentially leads us to understate asset declines before death. French and Jones (2004) and Hurd and Smith (2001) find that this problem is relatively minor. Using AHEAD data, Hurd and Smith find that medical expenses just before death are $4,200 and death expenses (such as burial expenses) are $4,300. Nevertheless, they find that the size of the estate is on average $36,000 less than the self-reported level of assets in the interview before death.

REFERENCES

Altig, David, Alan J. Auerbach, Laurence J. Kotliko, Kent A. Smetters, and Jan Walliser, 1997, "Simulating U.S. tax reform," National Bureau of Economic Research, working paper, No. 6248.

Attanasio, Orazio P., and Hilary Williamson Hoynes, 2000, "Differential mortality and wealth accumulation," *Journal of Human Resources*, Vol. 35, No. 1, pp. 1–29.

Cagetti Marco, and Mariacristina De Nardi, 2003, "Taxation, entrepreneurship, and wealth," Federal Reserve Bank of Minneapolis, working paper, No. 632.

Castaneda, Ana, Javier Díaz-Giménez, and José-Víctor Ríos-Rull, 2003, "Accounting for U.S. earnings and wealth inequality," *Journal of Political Economy*, Vol. 111, No. 4, pp. 818–857.

Cheng, Ing-Haw, and Eric French, 2000, "The effect of the run-up in the stock market on labor supply," *Economic Perspectives*, Federal Reserve Bank of Chicago, Quarter 4, pp. 48–65.

Davies, J., and Anthony Shorrocks, 2000, "The distribution of wealth," in *Handbook of Income Distribution*, A. B. Atkinson and F. Bourguinon (eds.), Amsterdam: North-Holland, chapter 11.

Díaz-Giménez, Javier, Vincenzo Quadrini, and José-Víctor Ríos-Rull, 1997, "Dimensions of inequality: Facts on the U.S. distributions of earnings, income, and wealth," *Quarterly Review*, Federal Reserve Bank of Minneapolis, Vol. 21, No. 2, pp. 3–21.

De Nardi, M., 2004, "Wealth distribution, intergenerational links, and estate taxation," *Review of Economic Studies,* Vol. 71, No. 3.

De Nardi, C., Eric French, and John Jones, 2004, "Savings motives after retirement," Federal Reserve Bank of Chicago working paper.

Dynan, Karen E., Jonathan Skinner, and Stephen P. Zeldes, 1996, "Do the rich save more?," Board of Governors of the Federal Reserve System, manuscript.

Feenberg, D., and J. Skinner, 1994, "The risk and duration of catastrophic health care expenditures," *The Review of Economics and Statistics*, Vol. 76, No. 4, pp. 633–647.

French, E., and J. Jones, 2004a, "The effects of health insurance and self-insurance on retirement behavior," Federal Reserve Bank of Chicago, manuscript, based upon working paper, No. 2001–19.

__________, 2004b, "On the distribution and dynamics of health care costs," *Journal of Applied Econometrics,* forthcoming.

Hubbard, R., J. Skinner, and S. Zeldes, 1995, "Precautionary saving and social insurance," *Journal of Political Economy*, Vol. 103, No. 2, pp. 360–399.

__________, 1994, "The importance of precautionary motives in explaining individual and aggregate saving," *Carnegie-Rochester Series on Public Policy*, Vol. 40, pp. 59–125.

Hurd, M., 1990, "Research on the elderly: Economic status, retirement, and consumption and saving," *Journal of Economic Literature*, Vol. 28, No. 2, pp. 565–637.

__________, 1989, "Mortality risk and bequests," *Econometrica*, Vol. 57, No. 4, pp. 779–813.

Hurd, M., and J. Smith, 2001, "Anticipated and actual bequests," in *Themes in the Economics of Aging*, David Wise (ed.), Chicago: University of Chicago Press, pp. 357–389.

Juster, F. Thomas, James Smith, and Frank Stafford, 1999, "The measurement and structure of household wealth," University of Michigan, manuscript.

Palumbo, M., 1999, "Uncertain medical expenses and precautionary saving near the end of the life cycle," *Review of Economic Studies*, Vol. 66, No. 2, pp. 395–421.

Smith, J., 1999, "Healthy bodies and thick wallets: The dual relationship between health and economic status," *Journal of Economic Perspectives*, Vol. 13, No. 2, pp. 145–166.

U. S. Social Security Administration, selected years, *Social Security Bulletin: Annual Statistical Supplement*, Washington, DC: Government Printing Office.