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A note

Stock prices and house prices in California: new evidence of a wealth effect?

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1. Introduction

A crucial macroeconomic question facing the US economy is whether the value of the stock market has implications for consumption. If it does, it means that any severe downturn in the market could lead to a contraction of consumption, and therefore a contraction in the overall economy.

The issue is one on which academics and the financial community seem to disagree. Rigorous academic works (Fama, 1981; Fisher and Merton, 1984; Barro, 1990; Poterba and Samwick, 1995), have generally found that the wealth effect on consumption is quite small, while research reports from financial service companies generally assert that the effect is real and important.

This paper is different from its predecessors in that it focuses on one particular market: the San Francisco Bay area housing market. It will argue that this market is a prime candidate for a wealth effect to be large, and it will compare it to another market (Southern California) where we would expect the effect to be considerably smaller. We find that under circumscribed conditions, it is possible to find a strong wealth effect in a particular market[1].

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[1]The wealth effect tested here is different from the effect in Muellbauer and Murphy (1997), who found that financial market liberalization had an impact on house prices, which in turn could affect consumption.

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While the San Francisco Bay area housing market is relatively small geographically, it is important for a number of reasons. First, it is a very expensive housing market[2], and therefore consumes a disproportionately large amount of housing capital. Second, because it is a very expensive housing market, its mortgages are ''non-conforming,'' or ineligible for sale to Fannie Mae or Freddie Mac. This means that investors purchase these mortgages without an implicit guarantee of repayment from the federal government. Should large numbers of these mortgages default in response to a wealth-effect induced decline in house prices, the consequences for the financial system could be unpleasant.

The remainder of the paper is organized as follows: I describe some theoretical bases for a wealth effect in housing markets. Next I discuss results from past papers about wealth effects, and why the San Francisco Bay area may depart from past results. Next, the model that will be used to reveal whether or not there is a wealth effect will be discussed. I then describe the data used to fit the model, present results and draw some conclusions.

2. Whence the wealth effect?

Macroeconomic textbooks suggest that consumption is largely a function of two things: labor income and wealth. Simply put, because wealth produces income in the form of dividend and interest payments, households with more wealth than others can be expected, ceteris paribus, to consume more. Higher wealth households also have higher levels of permanent income than lower wealth households with the same amount of labor income. It therefore does not seem like a great leap of logic to think that as the stock market rises, so too does wealth, and therefore consumption.

There are a number of problems with this view, however. First, if stock values rise because interest rates are falling (and therefore because price earnings ratios are rising), it is not necessarily the case that the income produced by wealth is rising. Second, if the Ando and Modigliani (1963) life cycle hypothesis is correct, only unanticipated changes in wealth should lead to higher levels of consumption, because households try to smooth their consumption across their lifecycle in the face of anticipated changes in wealth. Therefore, anticipated changes in stock values should have no effect on consumption. Finally, from a macro-economic perspective, the effect of stock prices on consumption might be relatively small, because stocks are generally not broadly held. According to the Federal Reserve Board of Governors' (1995) Survey of Consumer Finances, only 27% of households in the United States in 1995 owned any stock (including mutual funds)

[2] According to the National Association of Realtors, Existing Home Sales Report (1999), the San Francisco housing market has the highest median house price of any market in the continental in the United States, and San Jose is not far behind.

at the personal level at all, although 37% had retirement accounts, some of which presumably contained stocks. Of those households who held stocks directly, the median value of holdings was US$8,000. For those who held mutual funds, the median value was US$19,000. Finally, for those holding retirement accounts, the median value was US$15,600. Thus, for the typical American household, it is unlikely that changes in stock market values will have much impact on consumption. We should also note that all financial assets are held disproportionately by the elderly. This could well have implications for tests involving the housing market, because the elderly typically buy less often than younger people.

Yet all of this does not rule out the possibility of important wealth effects in certain markets under certain circumstances. Specifically, when stock gains are unanticipated, they could have an influence on consumption even within a life-cycle framework. Moreover, high-income households, who are more likely to have substantial stock holdings, could also adjust their consumption in response to changes in stock prices. Finally, when stock prices rise, the share of households' portfolios in the stock market will rise, and households will have a desire to rebalance their portfolios by selling shares and purchasing other assets (Markowitz, 1952).

The stock market could also have an influence beyond its impact on household wealth. If workers are paid with shares, and the value of shares rises, current income, as well as wealth, could be influenced by changes in stock prices.

Housing is both a consumption and an investment good, so we might expect high-income households with unanticipated gains in share prices to increase the amount of housing that they own. Here is where the San Francisco Bay area housing market comes in. We know that the Bay Area has the following characteristics: it has the highest household income level of any large MSA in the United States. The popular press tells myriad stories of how common it is for workers to be paid with stock options, rather than wages, in the San Francisco area in general, and in the San Jose area in particular (see *Wall Street Journal*, 2 September 1999, p 2). Thus current income is a function of both cash income (which is reported) and stock. These stories are buttressed by a recent survey performed by the California Association of Realtors (see Krueger and Cauley, 1999), which shows that homebuyers in the Bay Area are roughly three times more likely to have their behavior influenced by stock performance than are homebuyers in Southern California. Finally, we will be able to identify demand shifts for housing in the San Francisco Bay area because housing supply there is among the most inelastic in the country (see Malpezzi and Green, 1996; Mayer and Somerville, 1999)[3]. Thus changes in housing demand will be reflected largely in price, which is largely observable, rather than quantity.

[3]Data from the C-40 series of the Census show that the ratio of job growth to housing unit permits in the Bay Area was more than twice the national average over the 1990s. This also supports the assertion that housing supply there is inelastic by national standards in the Bay Area.

To test whether there is a wealth effect in the San Francisco Bay area, we lean on tests of Granger Causality, which we shall describe briefly below. As a control, we also test for Granger Causality in the Los Angeles area, a place where stock ownership does not appear to be as ubiquitous as it is in the San Francisco Bay area.

3. A brief description of Granger Causality

The idea behind Granger Causality is a simple one: if a lagged explanatory variable can improve the forecast of a dependent variable after the lagged dependent variable is taken into account, the explanatory variable is said to ''Granger Cause'' the dependent variable. That is, if we estimate:

$$y_t = \alpha_0 + \sum_{i=1}^{k} \alpha_{t-i} y_{t-i} + \sum_{i=1}^{k} \beta_{t-i} x_{t-i}$$

and an F-test rejects the hypothesis that the $\exists s$ are jointly equal to zero, we may say that we reject the null hypothesis that x does not Granger Cause y. Poterba and Samwick's (1995) empirical tests are much in this spirit[4], although they do not specifically perform Granger tests.

For tests of Granger Causality not to be spurious, the time series data must have certain well-behaved properties, the most important of which is that they be stationary. We therefore pretest the data to assure that the data are stationary—that they do not contain unit roots. Details on unit root tests and Granger tests may be found in Hamilton (1994).

Our specific tests will find whether stock values do or do not Granger Cause house prices in four California markets: San Jose, San Francisco, Los Angeles County, and Orange County, and whether house prices in these markets Granger Cause the stock market. We perform the second of these because if we reject the null of the Russell not causing house prices and accept the null of house prices not causing the Russell, we can be reasonably be sure that our results are not spurious (Guilkey and Salemi, 1982).

While a finding of Granger Causality does not prove the existence of a wealth effect, it is empirically consistent with such an effect[5]. Indeed, in testing whether

[4]PS test whether the Standard and Poors 500 helps predict consumption of all goods and of luxury goods. They find that it does not help predict consumption of all goods, and only weakly predicts consumption of luxury goods.

[5]As a referee notes, only a general equilibrium model of the housing market would provide something closer to proof. Unfortunately, high frequency data are not available for a large number of variables that would go into such a model.

the stock market Granger Causes house prices, we are jointly testing a number of propositions:

1. Stock ownership is sufficiently widespread to affect consumption.
2. The life-cycle hypothesis is correct and changes in stock values are unanticipated.
3. That changes in demand for housing is reflected in changing price rather than quantity (i.e., that supply is inelastic).

4. Data

To represent the performance of the stock market, we use the Russell 2000 Index. We choose the Russell because it is broad and because it contains technology stocks, including many of the infamous .com stocks. For the San Jose area, it is particularly important to use an index that includes technology companies. It is also important to include technology stocks, because these stocks arguably provided unexpectedly high returns for a certain period of time. While this is a strong statement, the price–earnings ratios of many well capitalized companies, along with the strong capitalization of some companies who have never had positive earnings, suggests the possibility that the performance of many of these stocks was unexpected. It is unanticipated changes in values that might cause households to reconsider their estimate of their lifetime incomes, and therefore change their consumption behaviors within the life-cycle context.

To represent house prices, we use median price data from the California Association of Realtors for San Francisco County, Santa Clara County (which includes San Jose), Los Angeles County, and Orange County. Changes in median price can reflect changes in both price and quality—if the unit price of housing remains constant, and the average quality of houses that sell increases, median prices will rise. Nevertheless, work comparing the Realtor median house price series to constant quality house price indexes shows that the quality component of median price changes is relatively small (see Haurin et al., 1991)[6].

I present descriptive statistics for the four house price change series and the Russell 2000 index in Table 1. The data are monthly and extend from January 1989 to July 1998. Figures one through four compare log differences in the Russell 2000 index to log differences in the four markets. Note that a benefit to the time period is that it contained periods of both strength and weakness in all the housing markets as well as the Russell 2000.

[6]Repeat sales data, such as that produced by Case–Shiller–Weiss, would give a better measure of house prices, but they are only available quarterly, while the median price data are monthly.

Table 1
Descriptive statistics: first log differences (monthly)

	Mean	S.D.	*N*
San Francisco house prices	0.002	0.025	104
Santa Clara County house prices	0.004	0.042	114
Orange County house prices	0.001	0.024	114
Los Angeles County house prices	0.000	0.023	114
Russell 2000 Index	0.010	0.042	114

Table 2
Augmented Dickey–Fuller test on unit root for first log differences (monthly)

	Test statistic	1% MacKinnon critical value	*N*
San Francisco house prices	−5.11	−3.49	104
Santa Clara County house prices	−5.54	−3.49	114
Orange County house prices	−4.02	−3.49	114
Los Angeles County house prices	−4.53	−3.49	114
Russell 2000 Index	−6.39	−3.49	114

5. Pre-testing the data

We perform our analysis on first differences in log house prices and the log level of the Russell 2000. We do so because house price levels and the level of the index is obviously not stationary. We test for the stationarity in first differences of log levels with Dickey–Fuller tests. Table 2 shows that the null hypothesis of unit root is rejected for all these series, so we may perform Granger tests.

6. Granger test results

Table 3 presents the *F*-test statistics for eight different Granger tests: that the Russell 2000 does not Granger Cause house prices in San Francisco, Santa Clara

Table 3
Granger tests

	F-Statistic	Probability null is true
San Francisco house prices Cause Russell 2000	0.81	0.45
Santa Clara County house prices Cause Russell 2000	0.83	0.44
Orange County house prices Cause Russell 2000	0.79	0.46
Los Angeles County house prices Cause Russell 2000	0.64	0.53
Russell 2000 Index Causes San Francisco house prices	4.50	0.01
Russell 2000 Index Causes Santa Clara County house prices	4.11	0.02
Russell 2000 Index Causes Orange County house prices	0.78	0.46
Russell 2000 Index Causes Los Angeles house prices	0.50	0.61

Null hypothesis is that the explanatory variable does not Granger Cause the dependent variable.

County, Los Angeles County, and Orange County, and that house prices in these markets do not Granger Cause the Russell 2000, as well as critical values for these statistics. We perform these tests with a lag of 2 months, because housing purchases generally require 30 to 60 days from offer to closure.

We first turn to the second set of tests. Note that in all four markets, we cannot reject the null hypothesis that house prices do not Granger Cause the Russell. This is good news from two perspectives: it conforms to intuition, which would suggest that there is no reason to expect price changes in a local housing market to ''cause'' price changes in the stock market, and it helps assure that tests of causation in the other direction are reliable.

And so it is especially striking that the results from Northern and Southern California are so different from one and other. Note that for the two Bay Area places, the *F*-statistics are considerably higher than the 95% critical value; for the two Southern California places, they are considerably lower. Thus in the place where we would expect the wealth effect to be stronger, we have evidence consistent with that expectation.

The results also appear to be quite stable over time. I performed CUSUM tests of coefficient stability for the two markets in which stock prices lead house prices, and found that the test statistic does not cross the 95% confidence bar for determining that coefficients have changed.

There remains a question, however, about the economic importance of the effect: even though the Russell adds to our ability to predict house prices in San Francisco and Santa Clara County, we might reasonably ask the size of the effect. We therefore present Table 4, which gives the parameter estimates of the two Granger equations where the Russell does help predict house prices.

Consider the equation for San Jose. The parameters for the two lags on the change in the Russell Index are 0.21 and 0.15, respectively. This means that a one

Table 4
Regression coefficients San Francisco and Santa Clara County Granger tests

	San Francisco	Santa Clara County
Russell lagged once	0.17	0.21
	(0.06)	(0.08)
Russell lagged twice	0.02	0.15
	(0.06)	(0.09)
San Francisco house prices lagged once	−0.05	
	(0.10)	
San Francisco house prices lagged twice	−0.02	
	(0.10)	
Santa Clara County house prices lagged once		−0.44
		(0.09)
Santa Clara County house prices lagged twice		−0.05
		(0.10)
Constant	0.00	0.001
	(0.00)	(0.004)

time increase in the value of the Russell of 1% will lead to an increase in house prices of 0.88% after 1 year (after a year, the effect of the stock market on prices dies out almost entirely). Thus it is fair to say that in the San Jose Market, the Russell 2000 is not only a statistically significant predictor of house prices—it is an important predictor.

The influence in San Francisco is not nearly so profound. The parameter estimates for the two lags on the Russell are 0.17 and 0.02 (and the second lag is not remotely significantly different from zero). As a result, a 1% increase in the Russell produces only a 0.22% increase in house prices after 1 year. Still, while this influence is nowhere near as strong as it is in San Jose, it is not trivial, either.

7. Tentative conclusions

Within the academic literature, past attempts at finding a ''wealth effect'' on consumption have largely been unsuccessful. When one considers how many joint-tests are embedded in the effect, this is not particularly surprising: for changes in equity values to have a measurable impact on consumption, stock holdings must be wide-spread, changes in stock prices must be unanticipated, and changes in prices must be the result of something other than a change in the discount rate. If any one of these three things is not true, we should not expect to discern a wealth effect on consumption.

In the Northern California housing market, it is likely not unreasonable to expect that all the conditions listed above hold true. Households have high incomes and therefore are more likely to hold relatively large amounts of stock. We have some evidence, moreover, that workers in the region are more likely to be paid in stocks than are workers in other parts of the country. We also have reason to expect that the valuations of many companies in Northern California were unexpectedly high. Finally, given that many companies had high capitalizations in the absence of earnings, we have reason to believe that it is something other than a changing discount rate that is changing values.

And so it is that we have evidence consistent with the notion that stock values influence housing consumption in Northern California. The evidence becomes more persuasive when we compare the results with those from Southern California. One could argue that the Northern California results reflect rising expectations about the national economy in general, which can be reflected in both stock and house prices. But the contrasting results with Southern California suggest that this, by itself, is not a sufficient explanation.

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