The Relationship Between House Prices and the Current Account

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Abstract: Using a broad cross-section of countries we document a robust negative relationship between the growth rate of house prices and the change in a country's current account balance. The empirical correlation is consistent with a real, multi-country model so long as consumption of housing and consumption of market goods are sufficiently complementary. We calibrate the model to data from the United States, Asia, and the European Union. We show that, given realistic assumptions of the future growth rate of consumption across the three regions, the model is capable of generating the observed change in current accounts and house prices in the three regions.

[1] Federal Reserve Board of Governors. The opinions expressed herein are those of the authors and do not reflect the views or opinions of the Federal Reserve Board or its staff.

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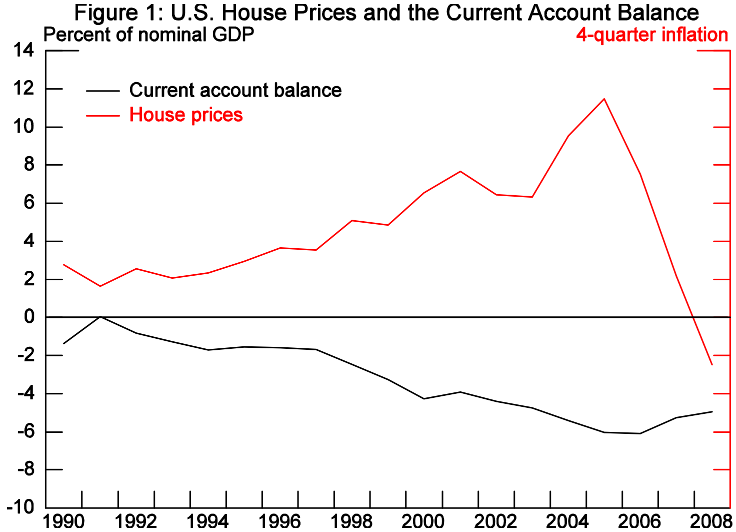
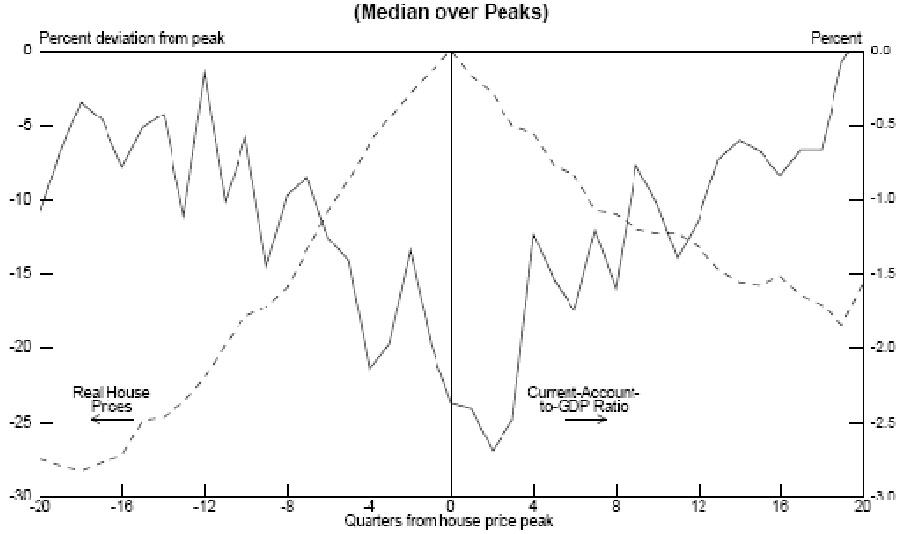
Introduction

Figure 1: U.S. House Prices and the Current Account Balance



Between 1991 and 2006, the current account balance as a percent of GDP in the United States deteriorated substantially, moving from roughly zero to over 6 percent, a level 80 percent lower than the previous nadir reached in the mid-1980s. Over the same period, real house prices increased more than 40 percent.[2] In comparison, over the 18 years leading up to 1993, real house prices increased a meager 6.3 percent and the current account was essentially unchanged in levels.

Chart 3.11
Current-Account-to-GDP Ratio and Real House Prices
(Median over Peaks)



The relationship between the current account and house prices is robust across countries and across time. In a 2005 study, Federal Reserve staff documented a negative

[2] Real house prices are computed as the FHFA's national house price index deflated by the overall CPI.

relationship between the current account balance and house price inflation.[3] As shown in Chart 3.11 taken from their study, peaks in house prices are associated with a marked deterioration in the current account balance. In the median episode, the current account falls from near balance to -2.5 percent of GDP.

In this paper, we provide further evidence of the empirical link between house prices and the current account. Using data over a large cross-section of countries and extending the study to include all time periods not just those associated with sharp rises in house prices, we show that the negative relationship between house price appreciation and the current account is robust. The relationship is also remarkably similar in terms of magnitude across the major industrialized economies.

The negative relationship between the two macro series is not surprising. The current account (in principal) reflects differing income growth expectations across countries: countries that are expected, in relative terms, to grow quickly should run current account deficits.[4] Likewise, housing is an asset and its price should embed future expected increases in earnings. So long as consumption of housing and consumption of other goods are sufficiently complementary, any increase in expected earnings should be reflected in an increase in house prices.

Further, as housing is a long-lived asset and therefore also embeds the long-term interest rate, the negative relationship between house prices can hold up even if a set of foreign economies comes to expect slower future growth rather than faster, as the slower expected growth puts downward pressure on real interest rates and upward pressure on the prices of long-lived assets. We develop a real, multi-country model of house prices and real trade. We use the model to demonstrate the necessary complementarities to drive the empirically observed correlation.

In 2003, then Governor Bernanke identified an Asian savings glut rather than high Western income expectations as driving the pattern of global current account imbalances. We calibrate our model to observed consumption growth between 1992 and 1997 in Asia, the United States, and Europe. We use the model parameters to replicate the pattern of deficits in 1997 assuming expected consumption growth was equal to the history. Using the calibrated model, we find income expectations in 2007 that are consistent with the observed pattern of balances in that year. Consistent with Governor Bernanke, we find that pessimistic Asian growth expectations are sufficient to replicate the pattern of current account balances.

However, for the model to match both house prices and the current account simultaneously, pessimistic Asian expectations are not sufficient: expectations in both the United States and Europe must be optimistic. The deviations from the observed

[3] Ahearne, Alan, John Ammer, Brian Doyle, Linda Kole, and Robert Martin, 2005. "Monetary Policy and House Prices: A Cross-Country Study," International Finance Discussion Paper, 841.

[4] For simplicity, throughout the note we use expected income growth as shorthand for risk-adjusted growth. That is, a country with high variance and the same objective mean would have lower expected income growth in our use of the word.

growth rates between 2002 and 2007 is quite reasonable. Expectations of U.S. growth are within the range of expectations reported in the Federal Reserve's 2002 Monetary Policy Report to Congress (the range given is 3.5 to 4.5 percent).

Scatter Plots

Before turning to panel analysis, we graph the available data as a series of scatter plots. We show house price appreciation respectively against the level of the current account[5] and the first difference of the current account deficit. The level of the current account has no immediate relationship with the change in house prices; rather, the level of the current account is related to the level of house prices.[6]

However, as can be readily seen in the plot of the U.S. current account deficit and U.S. house prices above, both series show remarkable persistence, exhibiting ten-year or greater cycles. As a result, the negative relationship is robust in level terms as well as in changes. In the panel analysis below, we are able to go one step further and compare the relative change in current accounts and house prices across countries.

Annual Scatter Plots

Figure 2: House Prices and Current Account Balances, Annual

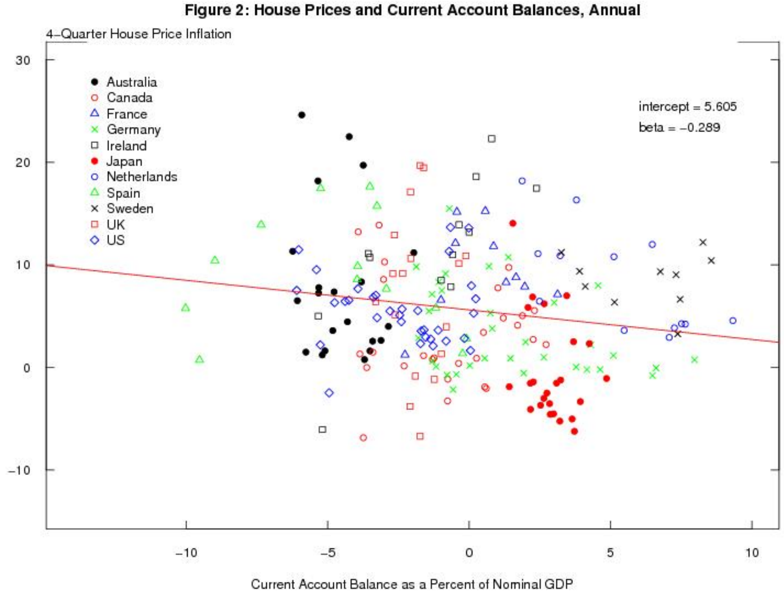


Figure 2 shows a scatter plot of the four-quarter change in national real house prices against the level of the current account balance as a percent of GDP. Each country is denoted by a unique symbol color pair. As is expected given the results shown above,

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[5] For comparability across countries, the current account is always normalized by nominal GDP.

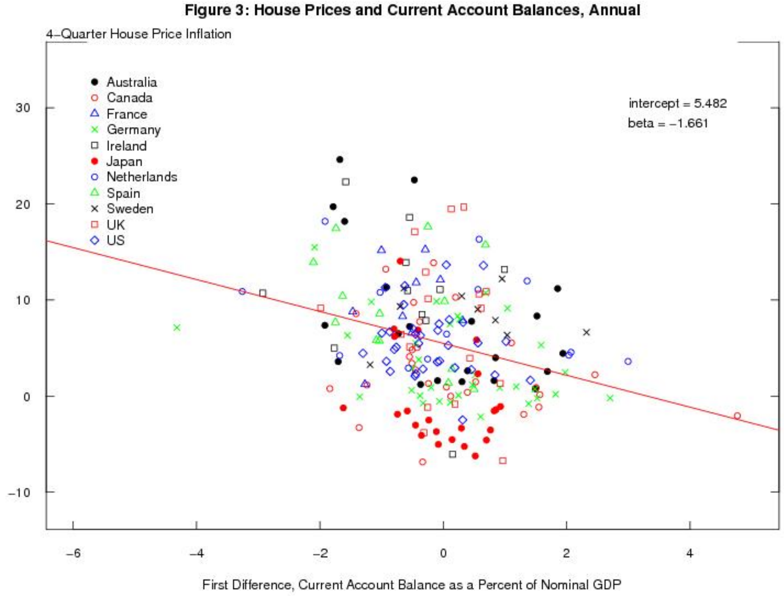
[6] In only a few of the advanced foreign economies is the level of house prices available. House price series are almost invariably given as an index.

there is a striking negative relationship between a country's current account balance and the rate of nominal house price appreciation. The slope of the regression line, -0.292, is significant at the 95 percent level.

The relationship across for individual countries is much weaker than the relationship for the group as a whole. For example, the red dots denoting annual pairs for Japan indicate only a small response between the level of the current account and house price appreciation. Yet, their consistent current account surplus places them at the lower end of house price appreciation. This is most clear if the black dots for Australia, a country with persistent current account deficits, are compared with the red dots for Japan.

Figure 3 shows a scatter plot of the four-quarter change in national nominal house prices against the first difference of the level of the current account balance. For example, the red dot, just above the regression line in the bottom right of figure 3, represents Canada's large positive change in the current account balance in 1982. Between 1981 and 1982, Canada's current account went from a 4.2 percent deficit to a 0.6 percent surplus: In that year, Canadian house prices fell modestly.

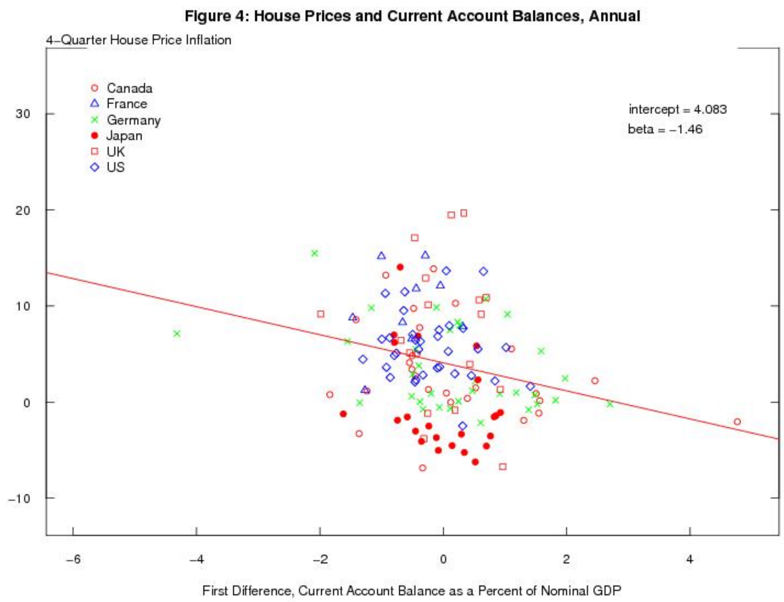
Figure 3: House Prices and Current Account Balances, Annual



The negative relationship between the change in the current account balance and house price appreciation is much stronger than in the levels plot. The coefficient in the regression retains its statistical significance but decreases in level to -1.695. That is, a one percentage point increase in the current account is associated with 1.7 percentage point faster annual house price appreciation. Moreover, the relationship seems to hold more robustly across individual economies not solely in the aggregate.

The red dots indicating Japan, while decidedly below the regression line, have approximately the same negative relationship. That is, even in Japan, an increase in the current account is associated with relatively lower house price appreciation. Country-by-country, the dots show a negative relationship.

The relationship at the individual country level can be seen more clearly in figure 4. This figure shows the same data as figure 3 using a subset of major economies. Germany, another country that is known for violating macro regularities, also shows a strong negative relationship. As well, in this case the two extreme outliers, one for Germany and one for Canada, exert attenuating pressure on the regression line. If these two points are removed the regression line has a substantially more negative slope.



Quarterly Scatter Plots

So far, the data shown has been annual. We now turn to quarterly data. In the plots, we continue to show four-quarter house price inflation to eliminate some unnecessary noise in the pictures. When we turn to panel analysis the frequency between house price changes and the current account will match.

Figure 5: House Prices and Current Account Balances, Quarterly

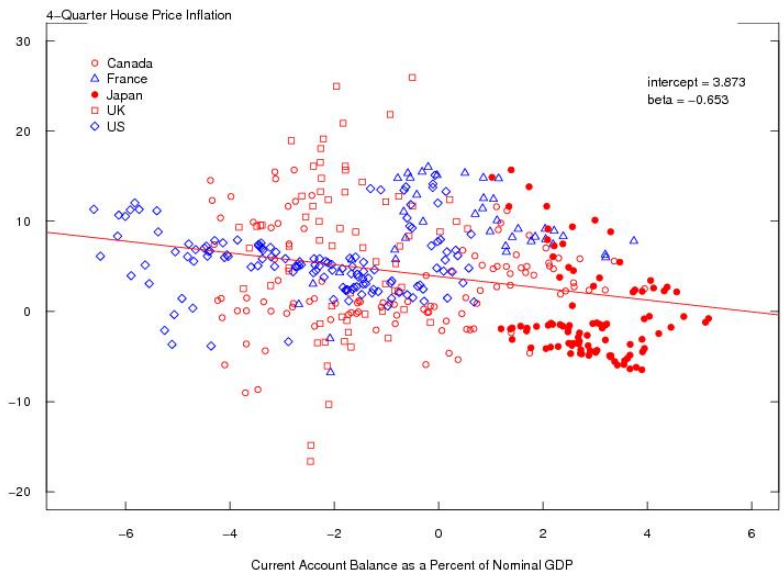


Figure 5 shows the four-quarter change in house prices against the level of the current account deficit as a percentage of GDP for quarterly data. As in the annual data, the negative relationship between the two series holds. The regression coefficient, -0.67, is statistically significant at the 95 percent level. Countries with large surpluses exhibit, on average, lower house price appreciation, than countries with large current account surpluses. As before, the relationship holds as a group but breaks down in individual countries. For example, the United Kingdom, shown as yellow x's, shows an almost vertical relationship, indicating a negligible relationship between the two series.

Figure 6: House Prices and Current Account Balances, Quarterly

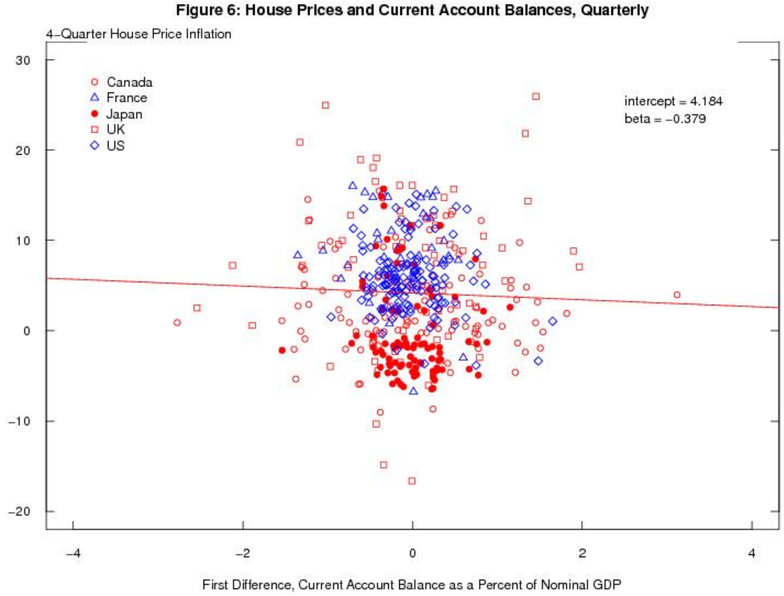
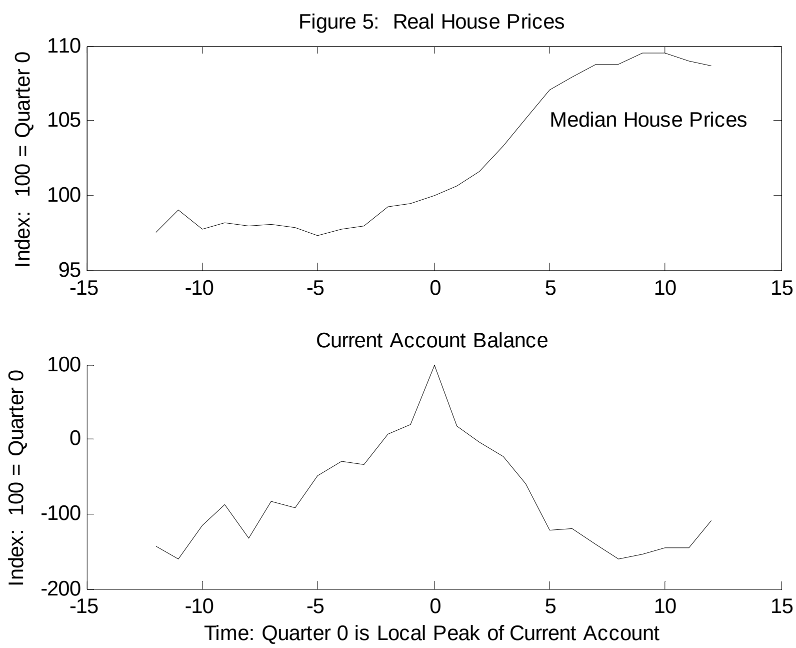


Figure 6 shows the change in house prices against the first difference in the current account. In contrast to the results with annual data, the relationship between house prices and the change in the quarterly current account is statistically insignificant. The regression coefficient, while negative, cannot be distinguished from zero. In the panel regressions, below, we show that the first two lags of the change in the current account are not significant. The third and fourth lags, however, are quite significant. We suspect that both slow adjustment in housing markets and noise in the pattern of quarterly current account balances lie behind the result.

There is likely substantial noise in the quarter over quarter current account balance. The timing of payments or rapid changes in prices can lead to fluctuations in the current account balance that are not economically meaningful. Averaging across episodes and countries may lead to a better idea of the underlying relationship. We saw this above in Chart 3.1. In that picture, the relationship between the current account and house prices was quite clear. That chart showed that surrounding house price peaks the current account was likely to reach a local low.

House Prices and Current Account Peaks

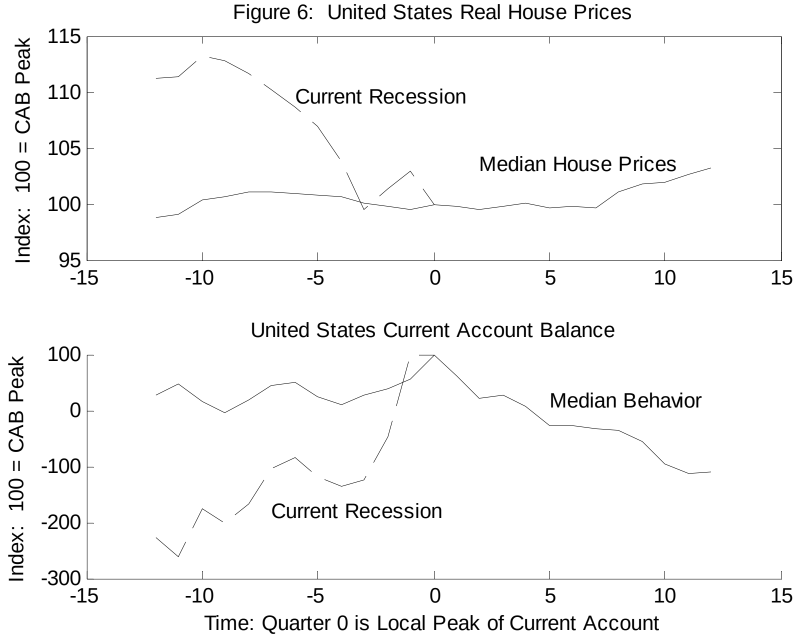


We extend the result of Ahearne et al. (2005) using essentially the same data set and centering the episodes around local peaks in the current account rather than peaks in house prices. The results are shown in figure 5. In the figure, the zero period is the quarter in which the current account reaches a two-year high. The advantage of using a local high in the current account is that it tends to give sufficient movement in the current account to establish a visual relationship.

On average across countries and episodes, the current account (shown in the bottom panel) rises (relatively) smoothly to a peak over three years. After reaching a high, the current account moves down, arriving at its low point after about two years. The behavior of house prices is shown in the top panel. House price growth is decidedly slower in the period before the peak in the current account balance relative to its growth rate after the peak. Real house prices increase a mere 0.8 percent per year on average prior to the peak and increase 2.8 percent per year on average after the peak. In the first two years after the peak as the current account balance is still falling rapidly, house prices rise 5.0 percent per year on average. That is, house prices increase 6 times faster following the peak in the current account. The period 2 to 3 years after the peak is also consistent with the negative relationship. As the current account stabilizes, house price appreciation becomes negligible.

As with the scatter plots above, the relationship is much weaker across episodes in individual countries than across all countries and all episodes. Figure 6 shows the same plot for the United States. Peaks in the current account in the United States generally have been mere respites before continuing collapses in the balance. As a result, the median peak is better characterized as the end of a stable period. Over these episodes, house prices fall on balance coming into the peak and rise on balance leaving the episode.

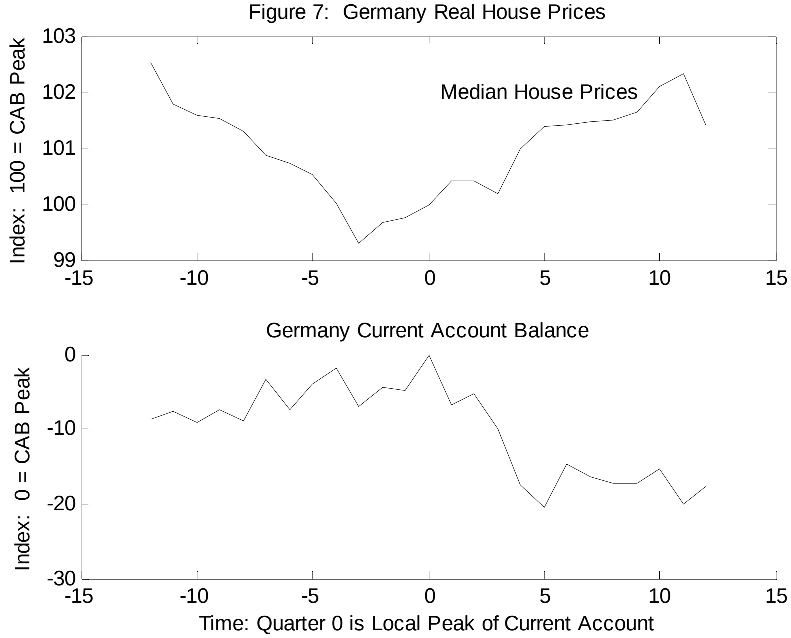
Figure 6: United States Real House Prices



Because the current recession has been associated with a remarkable fall in real house prices and a remarkable adjustment in the current account, we also show the behavior of both series in the current recession, assuming 2009Q2 is the peak in the current account. The negative relationship between the two is stunning.

Figure 7 shows data for Germany. Germany has maintained a consistent current account surplus since the early 1990s. Also, partly because of regulatory interference, house prices have fallen on balance in Germany over the same time period. While the timing of the turning points is not exact with real house prices reaching their nadir four quarters prior to the peak in the current account balance, the negative relationship is clearly visible. House prices fall on balance as the current account balance is increasing and rise as the current account balance decreases.

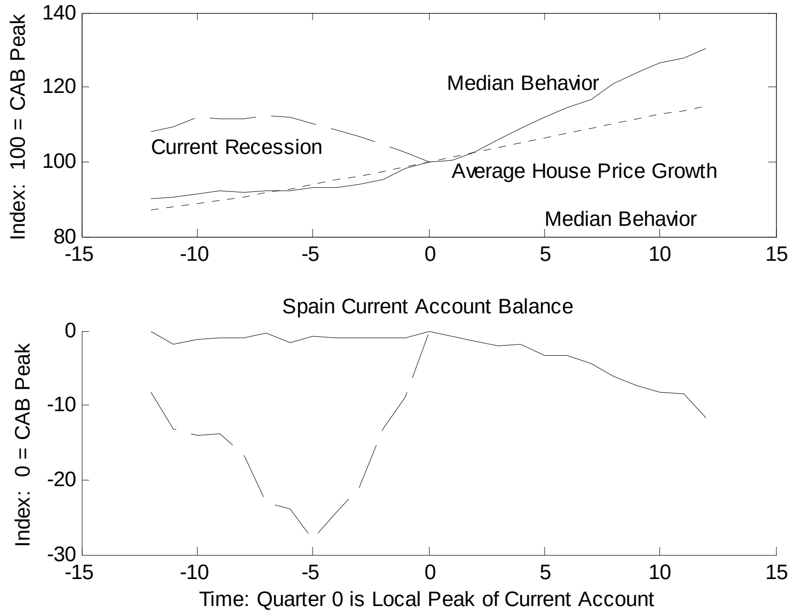
Figure 7: Germany Real House Prices



Spain is another interesting case being the exact opposite of Germany: house prices have been growing rapidly and the current account deficit has been growing increasingly negative. Figure 8 shows the data. In the case of Spain, house prices rise rapidly both before and after the peak in but the growth rate of real house prices is almost twice as fast following the peak in the current account. The dashed line shows the average path of house prices over all three year windows from 1970 to 2009.

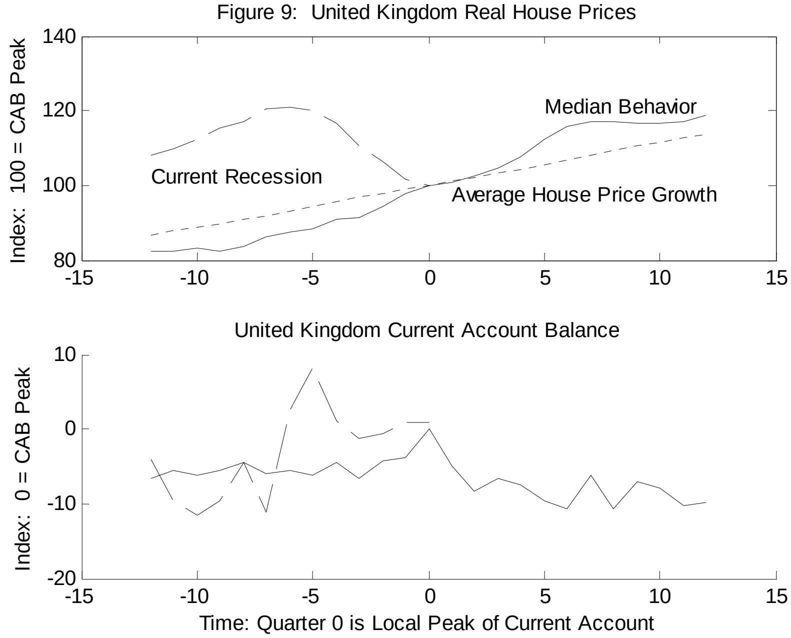
As with the United States, we also show the current recession. House prices have fallen considerably, especially relative to the recent trend. The current account balance has improved substantially.

Figure 8: Spain Real House Prices



Finally in figure 9, we show data for the United Kingdom. In the scatter plots above, we singled the United Kingdom out as a country for which the negative correlation did not seem to hold. The median episode confirms this result. Indeed, house prices rise approximately as fast before the peak as following the peak. Even in the current episode where movements in both house prices and the current account has been extreme, the relationship seems somewhat random.

Figure 9: United Kingdom Real House Prices



The Panel Regressions

We know turn to panel analysis of the data. We use the following specification for the first panel regression:

$$\Delta \log p_{i,t} = \alpha + \alpha_i + \boldsymbol{\beta} L(CA/GDP_{i,t}) + \boldsymbol{\gamma} L(\Delta \log p_{i,t}) + \boldsymbol{\delta X_{i,t}} + \boldsymbol{\varepsilon_{i,t}}$$

$L(.)$ is a lag operator, $\Delta \log p_t$ is the change in house prices, α_i is a country fixed effect, CA/GDP is the ratio of the nominal current account to nominal GDP, and the vector $\boldsymbol{X_t}$ is a vector of control variables. A subscript i indicates country i. The vectors **β**, **γ**, and **δ** are constant across countries. We stack the equations for the N countries and estimate them jointly using OLS. The panel regressions are run on data from the United States, the United Kingdom, Canada, Germany, France, and Japan. This subset allows us to keep the sample of countries constant across the annual and quarterly analysis, facilitating comparisons.

Annual Data

Table 1 shows the results of the regression. As with the scatter plots, we will first analyze the annual data and then examine the quarterly data. Model 1 uses one lag of the CA/GDP ratio and one lag of house price appreciation. The coefficient on the contemporaneous current account is negative and statistically significant. However, the relationship is undone in the first lag. Lagged house price appreciation is also significant and controls for part of the serial correlation in this series. The coefficient on house price appreciation remains unchanged in significance or magnitude across models. The model fits well across countries. The minimum R^2 is 0.38 and the average is just above 0.5.

Table 1: Dependent Variable: Change in House Price (ΔHP)

Annual	Model 1	Model 2	Model 3	Model 4
Constant	0.98**	-1.14*	0.45	1.21
CA/GDP	-0.73**	-0.60*	-0.55	-0.51
Lagged CA/GDP	0.87**	0.73**	0.99***	0.97***
Lagged ΔHP	0.73***	0.72***	0.66***	0.67***
ΔGDP	-	0.81***	0.71***	0.53**
ΔINT	-	0.20***	0.27	0.25***
Country Fixed Effects	-	-	yes	yes
US Recession	-	-	-	yes

* Significant at 90 percent; ** Significant at 95 percent; *** Significant at 99 percent.

Model 2 adds GDP growth and the change in the long-term interest rate as control variables.[7] Both are statistically significant. With the control variables in place the statistical significance of the relationship between the level of the current account and the change in house prices is diminished. This indicates, as theory predicts, that there is no systematic relationship between the level of the current account and the change in house prices.

Model 3 ads country fixed effects to the regression. With country fixed effects, the statistically significance of the contemporaneous CA on house prices disappears and the first lag of the current account is highly statistically significant and positive. The addition of country fixed effects significantly improves the fit of the model especially for Japan. Recall in the scatter plots above, the points for Japan fell consistently below the regression line. Allowing country fixed effects, the minimum R^2 rises to 0.5 and the average improves to 0.62.

Finally model 4 ads a dummy for U.S. recessions. This control variable controls to some extent for global output cycles. The coefficients on the recession dummy is never statistically significant and does not have a substantial effect on the other variables.

Table 2 adjusts the statistical model by replacing the level of the current account with its first difference as follows:

$$\Delta \log p_{i,t} = \alpha + \alpha_i + \boldsymbol{\beta} L\left(\Delta\left(CA/GDP_{i,t}\right)\right) + \boldsymbol{\gamma} L\left(\Delta \log p_{i,t}\right) + \boldsymbol{\delta X_{i,t}} + \boldsymbol{\varepsilon_{i,t}}$$

all other variables remain the same as in first specification. In this case, the relationship between the contemporaneous change in the current account and the change in house prices is robust with neither the maginitude of the coefficient nor its significance changes substantially across models. This statement is true as well for the first lag of the change in the current account, although the statistical significance of the lagged variable is marginal.

Table 2: Dependent Variable: Change in House Price (ΔHP)

Annual	**Model 1**	**Model 2**	**Model 3**	**Model 4**
Constant	1.11***	-0.95	-0.51	0.09
Δ(CA/GDP)	-1.17***	-1.15***	-1.20***	-1.20***
Lagged Δ(CA/GDP)	-0.66*	-0.53*	-0.61*	-0.58*
Lagged ΔHP	0.69***	0.67***	-0.61***	0.62***
ΔGDP	-	0.79***	0.75***	0.60***
ΔINT	-	0.23	0.29	0.27
Country Fixed Effects	-	-	yes	yes
US Recession	-	-	-	yes

* Significant at 90 percent; ** Significant at 95 percent; *** Significant at 99 percent.

[7] We also tried controlling for changes in inflation. This variable was almost never statistically significant.

The previous panels effectively assume that the shock occurring to each country is exogenous and the same. However, in reality, the countries are different in size and themselves may be experiencing different growth rates. In the case of very different growth rates particularly if the countries are different sizes, the relationship between house prices and the current account in the model (discussed below) is not well estimated by the above specification. However, an estimator that uses differential house price appreciation and differential change in the current account performs quite well.

Therefore, in the final annual panel, we examine the relationship between the relative house price appreciation between country pairs and their relative change in the current account. We modify the model as follows:

$$\begin{aligned} \Delta \log p_{i,t} - \Delta \log p_{j,t} \\ &= \acute{\alpha} + (\alpha_i - \alpha_j) + \boldsymbol{\beta} L\left(\Delta\left(CA/GDP_{i,t}\right) - \Delta\left(CA/GDP_{j,t}\right)\right) \\ &+ \boldsymbol{\gamma} L\left(\Delta \log p_{i,t} - \Delta \log p_{j,t}\right) + \boldsymbol{\delta}\left(\boldsymbol{X_{i,t}} - \boldsymbol{X_{j,t}}\right) + \left(\boldsymbol{\varepsilon_{i,t}} - \boldsymbol{\varepsilon_{j,t}}\right) \end{aligned}$$

Clearly, if the above models hold this system will as well. However, this specification may help control for common shocks, such as changes in commodity prices that may influence the individual country equations. For example, we might expect oil producers and oil importers to respond differently to an oil price shock over and above the changes in expected income growth.

Notice, we continue to allow a constant in the model, ά. This constant is not the same as the one before. That constant should difference out in this specification. We have no theoretical reason for including this parameter, but hesitate to impose a constant of zero. Only in the Model 1 is the estimated constant statistically different from zero. The country fixed effects become pair wise fixed effects. We stack the equations for all unique country pairs.

Table 3: Dependent Variable: Relative Change in House Price ($\Delta HP_i - \Delta HP_j$)~

Annual	Model 1	Model 2	Model 3	Model 4
Constant	0.67**	0.40	0.02	-0.08
$\Delta CA/GDP_i - \Delta CA/GDP_j$	-1.49***	-1.37***	-1.55***	-1.57***
Lagged ($\Delta HP_i - \Delta HP_j$)	0.66***	0.65***	0.55***	0.55***
$\Delta GDP_i - \Delta GDP_j$	-	0.68***	0.74***	0.75***
$\Delta INT_i - \Delta INT_j$	-	-0.17	-0.20	-0.16
Country Fixed Effects	-	-	yes	yes
US Recession	-	-	-	yes

* Significant at 90 percent; ** Significant at 95 percent; *** Significant at 99 percent.
~ Equations in table 3 are computed using unique country pairs.

The results are shown in Table 3. Once again, the coefficient on the difference between changes in the current account between country pairs is highly statistically significant and does not change substantially across model specifications. A country with a one percentage point larger increase in the current account than any other country should expect approximately 1.5 percentage points per year faster house price appreciation. The fit of the regressions was good across country pairs with the exception of the relationship between Japan and Germany. In these cases alone, the fit of the model is robustly rejected.

Quarterly Data

In this section, we repeat the models from the previous section in the same order using quarterly data instead of annual data. The main difference between the two sets of analysis is the use of extra lags of the current account. For consistency, we use quarterly changes in house prices rather than four quarter changes.

Table 4 shows the relationship between the level of the current account and the change in house prices. We include four lags of the current account and one lag of house prices. As before the coefficient on lagged house prices is highly statistically significant and does not change substantially across models.

In a break from the annual data, the second lag of the current account is negative, statistically significant, and the statistical significance improves as control variables are added to the regression. Despite the use of quarterly data, the individual country fit of the regressions is quite good with the lowest R^2 in model 1 falling near 0.4 and the average falling near 0.66.

Table 4: Dependent Variable: Change in House Price (ΔHP)

Quarterly	Model 1	Model 2	Model 3	Model 4
Constant	0.11**	0.02	0.26**	0.30**
CA/GDP	-0.02	-0.01	0.01	0.02
Lagged CA/GDP	-0.23**	-0.24***	-0.23***	-0.23***
Second Lag CA/GDP	0.11	0.11	0.11	0.10
Third Lag CA/GDP	0.13*	0.13*	0.17**	0.17**
Lagged ΔHP	0.84***	0.82***	0.80***	0.80***
ΔGDP	-	0.15**	0.14***	0.14**
ΔINT	-	-0.14	-0.12	-0.13
Country Fixed Effects	-	-	yes	yes
US Recession	-	-	-	yes

* Significant at 90 percent; ** Significant at 95 percent; *** Significant at 99 percent.

Table 5 shows the relationship between the change in house prices and the change in the current account. In this case, the first two lags of the current account are never statistically significant and indeed the point estimates themselves are quite near zero. The third and fourth lags of the current account are statistically significant and are robust to model specification. A one percentage point increase in the current account is associated with a 0.22 percent decrease in the quarterly growth rate of house prices, about 1 percent at an annual rate.

Table 5: Dependent Variable: Change in House Price (ΔHP)

Quarterly	Model 1	Model 2	Model 3	Model 4
Constant	0.09*	-0.01	-0.10	0.13
Δ(CA/GDP)	-0.03	-0.04	-0.05	-0.05
Lagged Δ(CA/GDP)	-0.02	-0.10	-0.02	-0.01
Second Lag Δ(CA/GDP)	-0.22***	-0.22***	-0.23***	-0.22***
Third Lag Δ(CA/GDP)	-0.12*	-0.12*	-0.13*	-0.13*
Lagged ΔHP	0.85***	0.84***	0.81***	0.81***
ΔGDP	-	0.17***	0.17***	0.17***
ΔINT	-	-0.14	-0.13	-0.13
Country Fixed Effects	-	-	yes	yes
US Recession	-	-	-	yes

* Significant at 90 percent; ** Significant at 95 percent; *** Significant at 99 percent.

Table 6 shows the relationship between differential changes in the current account on the differences in house price appreciation using all unique country pairs. The basic finding remains intact. A one percentage point differential in the change in the current account is associated with a 0.27 percentage point difference in house price appreciation, about 1.1 percentage points at an annual rate. The coefficients and their statistical significance is robust to model changes.

Table 6: Dependent Variable: Relatvie Change in House Price (ΔHP_i - ΔHP_j)~

Quarterly	Model 1	Model 2	Model 3	Model 4
Constant	0.11**	0.09*	0.07	0.05
$\Delta CA/GDP_i$ - $\Delta CA/GDP_j$	-0.06	-0.09	-0.08	-0.08
Lagged ($\Delta CA/GDP_i$ - $\Delta CA/GDP_j$)	-0.01	-0.03	-0.02	-0.02
Second Lag ($\Delta CA/GDP_i$ - $\Delta CA/GDP_j$)	-0.26***	-0.23***	-0.28***	-0.27***
Third Lag ($\Delta CA/GDP_i$ - $\Delta CA/GDP_j$)	-0.10*	-0.07	-0.11*	-0.11*
Lagged (ΔHP_i - ΔHP_j)	0.83***	0.82***	0.79***	0.79***
ΔGDP_i - ΔGDP_j	-	0.13**	0.10	0.10
ΔINT_i - ΔINT_j	-	-0.24**	-0.23**	-0.23*
Country Fixed Effects	-	-	yes	yes
US Recession	-	-	-	yes

* Significant at 90 percent; ** Significant at 95 percent; *** Significant at 99 percent.
~ Equations in table 6 are computed using unique country pairs.

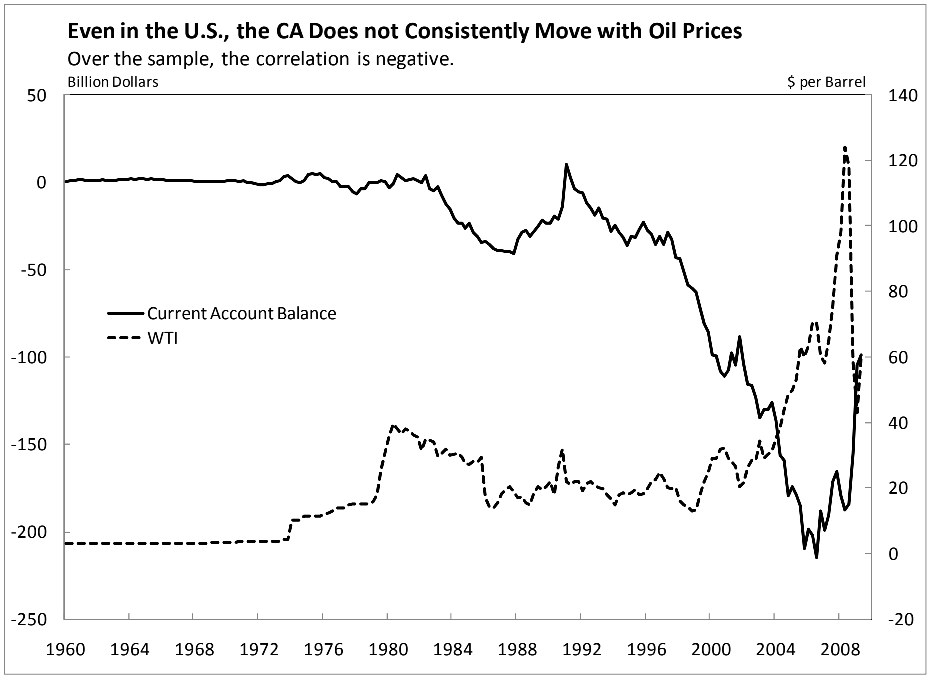
Oil Prices and the Current Account

One issue with the above analysis is the relationship between changes in oil prices and changes in the current account. Using the United States as an example, the current account balance seems to deteriorate with increases in oil prices. Yet, rising oil prices are also generally believed to have negative consequences for growth. The logic follows immediately: in this case, house prices and the current account should have a positive correlation.

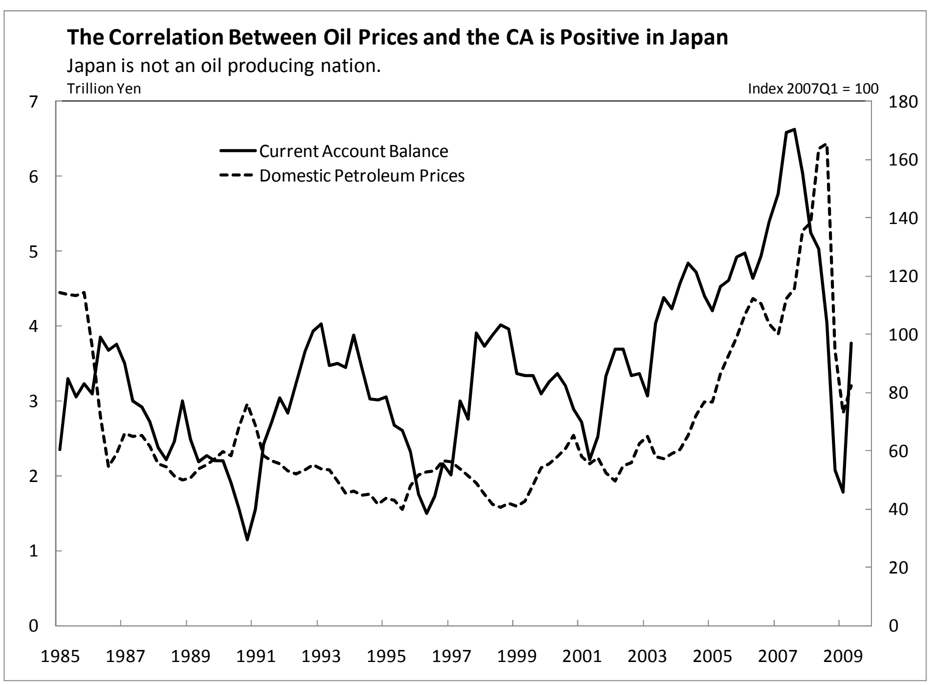
We do not dispute this possibility. The evidence presented above could have been generated regardless of the relationship in the two series during oil price episodes. Oil price spikes are rare events and the relationship during normal times could dominate these periods.

Yet, we would also note that an automatic negative relationship between oil prices, especially during extended periods of price increase, is not consistent with an expected income growth view of current account determination. The following graph shows the price per barrel of West Texas Intermediate oil and the nominal, quarterly current account balance for the United States. Over the entire sample, the correlation between the two series is very negative, -0.78.

However, the negative correlation is driven by three time periods: the early 1980s, 1997 to 2007, and 2007 to 2009. The first two occurred in the face of increasing oil prices and rapid U.S. growth. The last period had falling oil prices and falling U.S. growth. We submit that the change the relationship could have still been driven by evolving relative income expectations across the world.



The case of Japan aptly illustrates the point further. Japan has run a consistent current account surplus. Fluctuations in the domestic price of petroleum seem to have the opposite effect on Japan's current account balance as on the United States. Over the entire sample, the correlation between the domestic price of petroleum and Japan's current account balance is 0.5.



The Model

We have found a robust negative relationship between changes in the current account and house price appreciation. The analysis so far has been atheoretical and has focused solely on the empirical relationship. Yet, models of house price and current account determination abound. In general, they are not combined but the implications remain.

In this section, we build a stylized real model of the global economy. The model is based on the iconic endowment asset pricing model of Lucas. The model environment is comprised of three separate endowment economies. Each economy is populated by a single representative consumer who derives positive utility from the consumption of two goods. The first good, labeled market consumption, is an internationally tradable commodity. The second good, labeled housing and thought of as land, is not tradable. The model is real. The representative consumers have identical, time-invariant preferences.

Each economy receives a stochastic endowment of the market consumption good each period. This endowment may be freely traded in a global market. The economy is also endowed with a potentially stochastic sequence of land. In general, we will treat the quantity of land as fixed. Land is not tradable. Hence, the price of the consumption good will satisfy law of one price across economies. The price of land will potentially differ across economies.

Individual Agent/Country Optimization

Since the optimization problem is identical across countries, we omit country subscripts in this section. However, all quantities and the price of land are country specific. Only the price of bonds, which are traded on a common market, are the same across countries.

Each agent seeks to maximize lifetime utility subject to a period by period budget constraint as follows:

$$\max_{c_t,\, h_t,\, B_{t,t+s}} E\left\{\sum_{t=0}^{\infty} \beta^t U(c_t,\, h_t)\right\}$$

$$s.t.$$

$$c_t + \sum_{s=1}^{\infty} \delta_{t,t+s} B_{t,t+s} + p_t h_t \le y_t + \sum_{s=1}^{\infty} B_{t-s,t} + p_t h_{t-1}$$

where c is consumption and h is units of housing. Each period the agent chooses a portfolio of bonds. Each bond pays off one unit of consumption in a single future period and has price δ. For example, a bond paying one unit of consumption s periods in the future is denoted, $B_{t,t+s}$. This bond trades at price, $\delta_{t,t+s}$. Without loss of generality, the bond is not traded in the intermediate periods.

We have the following first order conditions for the model:

$$c_t: \; U_t(c_t, h_t) = \lambda_t$$

$$h_t: \; \lambda_t p_t = \beta^t U_h(c_t, h_t) + E\{p_{t+1}\lambda_{t+1}\}$$

$$B_{t,t+s}: \; E\lambda_{t+s} = \delta_{t,t+s}\lambda_t$$

These conditions are standard.

House Prices

An expression for house prices can be derived by combining the first order equations for market consumption and housing as follows:

$$p_t = \frac{U_h(c_t, h_t)}{U_c(c_t, h_t)} + \beta\, E\left\{\frac{U_c(c_{t+1}, h_{t+1})}{U_c(c_t, h_t)}\, p_{t+1}\right\}$$

The first term, , $\frac{U_h(c_t,h_t)}{U_c(c_t,h_t)}$, is the utility value of holding h units of housing today. This term is commonly called the rental value of housing. The second term is the value of selling the house in period t+1. This pricing equation is entirely standard. The price of housing is ex dividend and the rental value is the period by period dividend.

Following standard practice we can substitute for next period's price, deriving an expression for today's house prices solely in utility terms.

$$p_t = E\sum_{s=0}^{\infty}\beta^s \frac{U_h(c_{t+s}, h_{t+s})}{U_c(c_t, h_t)} = E\sum_{s=0}^{\infty}\beta^s \frac{U_c(c_{t+s}, h_{t+s})}{U_c(c_t, h_t)}\,\frac{U_h(c_{t+s}, h_{t+s})}{U_c(c_{t+s}, h_{t+s})}$$

Hence, the price of housing at time t is equal to the discounted value of future rents. The term $\beta^s\frac{U_c(c_{t+s},h_{t+s})}{U_c(c_t,h_t)}$ is the stochastic discount factor. We can use the first order condition for bonds to substitute market prices for this discount factor.

$$p_t = E\sum_{s=0}^{\infty}\delta_{t,t+s}\frac{U_h(c_{t+s}, h_{t+s})}{U_c(c_{t+s}, h_{t+s})}$$

This is the standard equation used to evaluate house prices (see for example Campbell et al (2009)[8]). The current price of housing is directly related to the real interest rate and the flow of future housing rents. All else equal, higher rents or lower interest rates yields higher house prices. This formulation is convenient because future interest rates (and to a lesser extent future rents) can be inferred from market data. However, there is substantial comovement between the interest rate and the value of future rents: both elements incorporate the marginal utility of future market consumption.[9]

Do house prices increase or decrease with higher consumption expectations? Higher future consumption raises both interest rates and rents. The net impact on house prices depends on which factor moves more. The answer turns out to rely on the relationship between housing and consumption in utility, U_{hc}.

House prices can be expressed as above as follows:

$$p_t = E \sum_{s=0}^{\infty} \beta^s \frac{U_h(c_{t+s}, h_{t+s})}{U_c(c_t, h_t)}$$

Then, house prices rise or fall with increases in future consumption depending on the sign of U_{hc}.

$$\frac{\partial p_t}{\partial c_{t+s}} = E\, \beta^s \frac{U_{hc}(c_{t+s}, h_{t+s})}{U_c(c_t, h_t)} \quad \forall\, s > 0$$

If U_{hc}. is positive (if the marginal utility of housing is increasing with consumption) then house prices rise with increases in consumption. This in turn is a restriction on the relative strength of intertemporal substitution of consumption and intratemporal substitution between housing and consumption.

Note a change in interest rates in the global model changes both the numerator and the denominator of the right hand side of the house price equation. A decrease in expected future wealth of foreign lowers interest rates and induces home to increase current consumption, lowering $U_c(c_t, h_t)$ and raising house prices. Martin (2005) contains a detailed explanation of these effects and the relationship between the two elasticities.[10]

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[8] Campbell, Sean, Morris Davis, Joshua Gallin, and Robert Martin. (2009) "What Moves Housing Markets: A Variance Decomposition of the Rent-Price Ratio." Journal of Urban Economics, forthcoming.
[9] Indeed, Campbell et al (2009) find substantial negative covariance between their estimates of future rent growth and future interest rates. They interpreted this as a time varying risk premium. Under their methodology they are unable to control for this comovement directly.
[10] Martin, Robert F. (2005) "The Baby Boom: Predictability in House Prices and Interest Rates," International Finance Discussion Papers, 847.

The Current Account

Combing the first order condition for bond holdings and the first order condition for market consumption, we have the following equation:

$$1 = \quad \beta\, E\left\{\frac{U_c(c_{t+s}, h_{t+s})}{U_c(c_t, h_t)}\ \delta_{t,t+s}\right\}$$

or rearranging

$$\delta_{t,t+s} = \quad \left(\beta\, E\left\{\frac{U_c(c_{t+s}, h_{t+s})}{U_c(c_t, h_t)}\right\}\right)^{-1}$$

In a standard result, a country will run a current account surplus (the country purchases a positive quantity of bonds payable in period t+s) if the following condition holds:

$$\delta_{t,t+s} < \quad \left(\beta\, E\left\{\frac{U_c(y_{t+s}, h_{t+s})}{U_c(y_t, h_t)}\right\}\right)^{-1}$$

That is, if a country is willing to pay more than the going rate to transfer consumption across time when utility is evaluated at the endowment, that country will purchase a strictly positive number of bonds that pay off in period t+s.

Comparing this equation across all countries, we find that countries that are expecting relatively high income growth are those that would be expected to run current account deficits.

Equilibrium

We impose the following aggregate resource constraints. The quantity of land in each country is fixed: $h_t = h_0$. All bonds are in zero net supply, which implies $\sum_{j=1}^{N} c_{j,t} \leq \sum_{j=1}^{N} y_{j,t}$, or total global consumption must equal total global income at each date. Then, equilibrium is defined as a set of prices and country-specific policy functions such that the policy functions satisfy the aggregate resource constraints when evaluated at the given prices.

Numerical Results

To generate numerical results, we must take a stand on the form of the utility function. Because the sign of U_{hc} is a key parameter for the calibration, we must choose a utility function that is sufficiently flexible to allow different values. Cobb-Douglass utility is too restrictive in this respect. Instead, we choose a more general form and use CES preferences as follows:

$$U(c_t, h_t) = \frac{(\alpha c_t^{\varepsilon} + (1-\alpha) h_t^{\varepsilon})^{\frac{1-\sigma}{\varepsilon}}}{1-\sigma}$$

The parameter α governs the relative shares of market consumption and housing in utility and will play almost no role in this exercise as it controls the level of house prices not the changes in house prices: high values of α imply low levels of house prices. The parameter σ governs the degree of risk aversion and the intertemporal elasticity of substitution. The parameter $\varepsilon \in (-\infty, 1)$ and is the most important parameter in the model. When $\varepsilon = 1$, market consumption and housing are perfect substitutes. At $-\infty$, the utility function is Leontief.

The parameters α, β, and σ will parameterize to their standard values in the literature. The value of β is set equal to 0.95, implying a risk free interest rate of around 5 percent. The interest rate is a bit high, but this will not affect the main results. α is set to 0.7 reflecting approximately thirty percent expenditure share to housing. In general, we will set the value of σ at 2, a standard value in macroeconomics. However, this parameter matters for the results, particularly for the sensitivity of the current account deficit to changes in expected income, so we will conduct some robustness checks allowing the parameter a broader range.

In all of the simulations, we will hold the housing stock constant. We prefer to think of the housing stock as land and under this interpretation holding the stock constant is reasonable. To avoid extreme prices, we also set the stock of land equal to first period income. In this manner, different house price dynamics across regions are not driven by a questionable assumption on the relative supply of land.

House prices and the current account as a function of ε

In this section, we demonstrate how the current account and house prices change in the model when future expected income growth changes in the model as the parameter ε changes from near perfect substitutes to near Leontief utility. These simulations are intended to give a feel for the model. In the calibration section below, we will restrict the model parameters by comparing the model economy with data. While the thought experiment continues to consider changes in risk adjusted future income, here the changes in income growth are certain and known.

Table 7 gives the results when ε is set to 0.9. Although there are three countries in the model, the foreign economies are identical and so we report only a single set of foreign statistics. The first column of the table shows the relative income growth of home. We consider values from 1 to 1.1. Because we eventually want to compare the model economy to the post-Asian-Financial-Crisis world, the base period of time shown is 11 years. So an income growth differential of 1.1 implies that after 11 years, home would have 10 percent higher income than foreign if they both start at the same point.

Table 7: House Prices and the Current Account
ε=0.9, σ=2, α=0.7, β=.95

Relative Home Income Growth	Home CA (%GDP)	Foreign CA (%GDP)	Home Price*	Foreign Price*
1	0.0%	0.0%	26.80	26.80
1.01	-0.6%	0.6%	-0.6%	-0.2%
1.02	-1.3%	1.3%	-0.6%	-0.2%
1.03	-1.9%	1.9%	-0.6%	-0.2%
1.05	-3.2%	3.2%	-1.2%	-0.4%
1.1	-6.2%	6.2%	-3.0%	-0.9%

*First row is the level of house prices; subsequent rows are changes.

The second column shows the size of home's current account as a percent of GDP; foreign's current account (in the third column) is the opposite of home's. When expected income growth is the same in both regions, the current account is zero. Home's current account goes into deficit as it expects higher income growth. The deficit reaches 6 percent of GDP when home expects 10 percent more income growth than foreign.

The corresponding house prices are shown in columns four and five. The first row of each column shows the level of house prices when income growth in both countries is equal. Subsequent rows show the percent change in prices as home's income growth increases. Because the elasticity of substitution between housing and market consumption is quite high (they are nearly perfect substitutes), house prices fall in both home and foreign as income prospects for home increase.

The fall in prices is large for home than for foreign. Both countries are exposed to increasing interest rates. Higher interest rates push down house prices. In home, however, this effect is compounded by falling rents. Under this parameterization, U_{hc} is negative so rents fall with rising consumption.

Table 8 runs through the same experiment with the value of ε moved to -1. The level of the current account deficit is only mildly changed under this change in elasticity. Indeed, with only one decimal place showing, the current accounts appear identical. In this case, the change in house prices moves negatively relative to the change in the current account balance. Foreign continues to be effected by the change in real interest rates; in home, the change in real interest rates is more than offset by the increase in future rents. In this case, house prices rise 3.5 percent relative to the baseline as the current account deficit moves to -6.2 percent of GDP. Notice, however, that the relationship between the percent change in house prices and the change in the current account differs across countries.

Table 8: House Prices and the Current Account
ε=-1, σ=2, α=0.7, β=.95

Relative Home Income Growth	Home CA (%GDP)	Foreign CA (%GDP)	Home Price*	Foreign Price*
1	0.0%	0.0%	0.21	0.21
1.01	-0.6%	0.6%	0.8%	-0.5%
1.02	-1.3%	1.3%	0.8%	-0.5%
1.03	-1.9%	1.9%	0.7%	-0.5%
1.05	-3.1%	3.1%	1.5%	-1.0%
1.1	-6.2%	6.2%	3.5%	-2.6%

*First row is the level of house prices; subsequent rows are changes.

The sign of the relationship between the current account and house prices is consistent with cross-country data; however, the magnitude of house price changes is miniscule compared to the experience in at least the United States over the past 10 years. Real U.S. house prices have rose more than 30 percent between 1997 and 2007. So, the model, if it is to match data, must be capable of producing larger house price changes. To do so, the elasticity of substitution between housing and market consumption must be substantially reduced.

In table 9, we boost the value of ε to -10. In the case, we get the extreme price movement of 76 percent as the current account deficit moves to 7 percent for home. This price movement is much larger than in the data, although the current account deficit is also larger than deficit for the United States at any point since 2007. But, this simulation shows that the model is indeed capable of accounting for very large swings in current account deficits.

Table 9: House Prices and the Current Account ε=-10, σ=2, α=0.7, β=.95				
Relative Home Income Growth	Home CA (%GDP)	Foreign CA (%GDP)	Home Price*	Foreign Price*
1	0.0%	0.0%	4.05	4.05
1.01	-0.6%	0.6%	11.1%	-2.8%
1.02	-1.3%	1.3%	11.2%	-2.8%
1.03	-2.0%	2.0%	11.3%	-2.8%
1.05	-3.3%	3.3%	24.3%	-5.6%
1.1	-6.9%	6.9%	75.5%	-13.4%

*First row is the level of house prices; subsequent rows are changes.

Of course, there is some debate as to whether or not a value of -10 for epsilon is reasonable. Different authors have come to different conclusions. In a similar model, Lustig and Van Nieuwerburgh (2005)[11] find a value of ε near -18 is necessary to match asset pricing moments. On the other extreme, Davis and Martin (2005)[12] find a value of ε close much greater than zero was need to simultaneously price housing and equities; they did not resolve the equity premium puzzle being unable to simultaneously price bonds. Using a different data set and a similar model to Davis and Martin, Piazzesi et al. (2006)[13] find a value of ε around -1.

House prices and the current account as a function of σ

In this section, we show the model's sensitivity to values of σ. We show only two examples. In table 10, we give results for ε of 0.9 and σ of 5. Then in table 11, we give results for ε of -10 and σ of 5.

Increasing the value of σ changed the sensitivity of the model to changes in ε but did not fundamentally change the results. When ε is high, house prices fall when the current account deficit increases; when ε is low, the negative relationship resumes. In the latter case, the increase in house prices is attenuated. Whereas before house prices rose over 75 percent when income was expected to rise ten percent with the high value of σ house prices only 60 percent.

[11] Lustig, Hanno, and Stijn Van Nieuwerburgh, 2005. "Housing Collateral, Consumption Insurance and Risk Premia: An Empirical Perspective," Journal of Finance, Vol. 60, No. 3, pp. 1167-1219.
[12] Davis, Morris, and Robert Martin, 2005. "Housing, House Prices, and the Equity Premium Puzzle," FEDS, 2005-13.
[13] Piazzesi, Monika, Martin Schneider, and Selale Tuzel, 2006. "Housing, Consumption, and Asset Pricing," Journal of Financial Economics, Vol. 83, pp 531-569.

Table 10: House Prices and the Current Account ε=0.9, σ=5, α=0.7, β=.95				
Relative Home Income Growth	Home CA (%GDP)	Foreign CA (%GDP)	Home Price*	Foreign Price*
1	0.0%	0.0%	4.80	4.80
1.01	-0.6%	0.6%	-1.8%	-0.5%
1.02	-1.3%	1.3%	-1.7%	-0.5%
1.03	-1.9%	1.9%	-1.7%	-0.5%
1.05	-3.1%	3.1%	-3.3%	-0.9%
1.1	-6.2%	6.2%	-7.8%	-2.1%

*First row is the level of house prices; subsequent rows are changes.

Table 11: House Prices and the Current Account ε=-10, σ=5, α=0.7, β=.95				
Relative Home Income Growth	Home CA (%GDP)	Foreign CA (%GDP)	Home Price*	Foreign Price*
1	0.0%	0.0%	0.40	0.40
1.01	-0.6%	0.6%	9.7%	-2.9%
1.02	-1.3%	1.3%	9.7%	-2.9%
1.03	-1.9%	1.9%	9.8%	-2.9%
1.05	-3.2%	3.2%	20.6%	-5.7%
1.1	-6.5%	6.5%	60.3%	-13.6%

*First row is the level of house prices; subsequent rows are changes.

House prices and the current account with different foreign assumptions

In this section, we explore the implications of different assumptions on the distribution of income in the foreign sector. In table 12, we show the results when the two foreign countries are very different in size. In this example, the large foreign country is twice the size of both home and small foreign. The difference in size does not impact the relative response of the home versus foreign. The change in the current account versus the change in house prices is identical. Note, in the table the current account as a percent of GDP does not sum to zero; however, the current account balances themselves, of course, do.

Table 12: House Prices and the Current Account - Large and Small Foreign ε=-10, σ=2, α=0.7, β=.95						
Relative Home Income Growth	Home CA (%GDP)	Foreign Large CA (%GDP)	Foreign Small CA (%GDP)	Home Price*	Foreign Large Price*	Foreign Small Price*
1	0.0%	0.0%	0.0%	4.05	2073.09	4.05
1.01	-0.7%	0.2%	0.2%	11.7%	-2.0%	-2.0%
1.02	-1.4%	0.5%	0.5%	11.8%	-2.0%	-2.0%
1.03	-2.2%	0.7%	0.7%	12.0%	-2.0%	-2.0%
1.05	-3.7%	1.2%	1.2%	25.7%	-3.9%	-3.9%
1.1	-7.6%	2.5%	2.5%	80.2%	-9.5%	-9.5%

*First row is the level of house prices; subsequent rows are changes.

In table 13, the relative growth rates of home versus foreign changes. In this case, the foreign economy labeled slow expects no income growth. Home expects moderate income growth and fast expects income growth twice as fast as home. Here the numbers for the current account and house price growth appear all over the map. The changes are quite large. However, the difference in difference estimator used to produce tables 6 and 3 above work quite well. The ratio of the change in house prices to the change in the current account is almost constant across different growth assumptions within country pairs. Across country pairs the standard deviation of the ratio is less than 0.1. It is this result that led us to use the difference and difference estimator in the empirical section.

Table 13: House Prices and the Current Account - Large and Small Foreign Differential Growth ε=-10, σ=2, α=0.7, β=.95						
Income Growth (Home, Slow, Fast)	Home CA (%GDP)	Foreign Slow CA (%GDP)	Foreign Fast CA (%GDP)	Home Price*	Foreign Slow Price*	Foreign Fast Price*
1;1;1	0.0%	0.0%	0.0%	4.05	4.05	4.05
1.01;1;1.02	0.0%	0.5%	-0.9%	5.3%	-7.7%	20.2%
1.02;1;1.04	0.0%	1.0%	-1.9%	5.5%	-7.8%	20.8%
1.03;1;1.06	0.0%	1.6%	-2.9%	5.7%	-7.9%	21.4%
1.05;1;1.1	-0.1%	2.7%	-5.1%	12.4%	-15.1%	49.4%
1.1;1;1.2	-0.5%	6.1%	-11.2%	39.2%	-32.0%	188.9%

*First row is the level of house prices; subsequent rows are changes.

*Relative to average foreign income growth.

To what extent do current account balances cause house price appreciation?

The question of causality is of course straight forward in the model: changes in income growth expectations influence both house prices and the current account; there is no direct causality between the current account and house prices. Yet, the point made by Bernanke and Roubini is valid. Inflows of capital are likely to drive up asset prices and an increase in savings abroad does put downward pressure on interest rates.

One way to approach the question is to compare the closed and open economy versions of the model and compare house prices between the two versions. In this sense, we can see what part of the rise in house prices can be "attributable" to the foreign sector and what part to home.

We conduct the exercise using the same parameters used to produce table 9 above restricting the current account of all countries to zero. The results on house prices are stunning. The second and third columns of table 14 provide the comparison. House price appreciation is cut by fifty percent without the ability to trade internationally.

Table 14: House Prices in Home
ε=-10, σ=2, α=0.7, β=.95

Relative Home Income Growth	Closed Economy	Open Economy
1	4.05	4.05
1.01	5.3%	11.1%
1.02	5.5%	11.2%
1.03	5.6%	11.3%
1.05	12.0%	24.3%
1.1	34.9%	75.5%

*First row is the level of house prices; subsequent rows are changes.

The intuition for this result is straightforward: interest rates rise more in the closed economy and rents rise more in the open economy. That is, home benefits from trade. This benefit can in a sense be measured by the change in house prices.

So, the intuition if the not the causality is correct when people make a link between the current account deficit and the rise in house prices. If the United States were a closed economy, house price appreciation would be much lower than in the open economy. In a sense, the capital flows associated with the current account do allow the increase in house prices.

Implications for Asian Growth Expectations

In this section, we compare output from the model with data from the United States, the European Union, and Asia. Our focus is the changes in these economies between 1997 and the 2006/07. We do not want to include the current crisis; rather, we are interested in the potential effects of the Asian Financial Crisis on global growth. In particular, we want to focus on the idea that the Asian Financial Crisis may have increased perceived risk in Asia, thereby lowering growth, and that it may have increased perceived growth rates in the United States and possibly the European Union. The idea behind the later being that lower production in Asia would leave a vacuum that U.S. and European manufactures might be able to exploit.

These three regions are, in our minds, representative of the global economy in this period. The United States is the nation with the large current account deficit, the Asia economies are running large surpluses, and the European Union has remained close to balance. But most importantly, the small changes in the current account of the European Union provides a significant restriction on possible model solutions, restrictions that are absent in a two country model.

The Euler equations that determine the current account balances and house prices take consumption and housing as inputs. Housing stock data is not available across countries so we will continue to set the initial stock of housing equal to the initial level of consumption. For consumption growth, we will adhere as closely as possible to realized consumption growth across the three regions.

Prior to the onset of the Asian Financial Crisis it seems reasonable to assume that the recent history would be a good guide for future income growth. Therefore, we assume that at the beginning of 1997 all three regions expected to continue growing at rate similar to what they had experienced over the previous five years.

In the second row of table 15, we plug in these realized growth rates (columns 1 to 3). The resulting current account balances are all of the right sign and are roughly of the correct magnitude. However, we find that if we increase the expected growth rate of European Union by about ½ percentage point, the resulting balances are much closer to the data. Given the forecast errors contained in most forecast models, we believe this adjustment to be reasonable. In any case, we will from this point forward assume this as our baseline.

Table 15: Consumption Growth, the Current Account, and House Prices (ε = -3.5 σ = 2 α = 0.7 β = 0.95)									
	Consumption Growth*			Current Account			House Prices**		
	US	EU	Asia	US	EU	Asia	US	EU	Asia
Target	2.9	2.6	2.5	-1.7	0.8	1.2	100	100	100
1992-1997 realized cons. growth	2.9	2.6	2.5	-1.1	0.5	1.0	100	100	100
Target	*3.5*	*2.1*	*3.2*	*-5.3*	*0.2*	*6.8*	*5.5*	*5.0*	*-2.9*
2002-2007 realized cons. growth	3.5	2.1	3.2	-2.9	4.2	-1.4	0.7	-1.4	0.9
2002-2007 pessimistic Asia	3.5	2.1	1.0	-5.8	1.4	6.7	4.2	0.0	-0.1
2002-2007 Pessimistic Asian, High US, High EU growth	4.2	3.1	2.0	-5.1	0.7	6.6	5.2	2.1	-4.5

Next, we are interested in the assumption necessary to replicate the pattern of current accounts that existed in 2007. By that time, the U.S. current account deficit had swollen to about 5.3 percent of GDP, the Asian surplus had increased to about 6.8 percent of GDP, and the surplus for the European Union had remained more or less unchanged. The fifth row of the table plugs in realized consumption growth rates over the five years ending in 2007. We find that the resulting current accounts implied by the model are too small (in absolute value) for the United States and Asia and too large for Europe. If expectations equaled the realization, we would have expected a current account deficit for the United States of -2.9 percent of GDP, a very large 4.2 percent of GDP surplus for Europe, and slight deficit for Asia.

Governor Bernanke in a 2003 speech, realizing the implications of the model, attributed the realizations of growth to overly pessimistic growth expectations on the part of the Asian economies. In our first attempt to match the current account pattern we take this approach, lowering growth expectations in Asian until the model pattern of current accounts is approximately the same as that observed in the data. If the Asian economies expected growth of a mere 1 percent per year rather than the realized 3.2 percent, the current account balances match. However, in this case, we would expect EU house prices to be unchanged and U.S. house prices to grow only 4.2 percent per year. House prices changes are not sufficiently large.

Therefore, we adjust the growth expectations of all three regions simultaneously, lowering Asian growth and raising growth expectations in both Europe and the United States. We find that raising U.S. income expectations from 3.5 percent to 4.2 percent, European expectations from 2.1 to 3.0 percent, and lowering Asian growth expectations from 3.2 percent to 1.0 percent yields both current account balances close to the realized levels and approximately the correct house price appreciation for the United States. House prices still rise insufficiently in the EU and fall excessively in the Asia.

The level of pessimism in Asia is easy to rationalize. The Asian economies in the mid-1990s looked unstoppable; yet, the growth rates proved unsustainable and the level of output fell sharply across Asia. A relatively small probability of a large fall in output is sufficient to lower growth expectations by a percentage point.

The growth rate for the United States seems too high. The realized growth rate of 3.5 percent was quite high in comparison to the long-term trend. Yet, it is possible. Remember, in the mid-2000s many observers of the U.S. economy were citing evidence of a productivity growth surge. Higher productivity growth should lead to higher consumption growth over time. In its Monetary Policy Report to Congress, the Federal Reserve presents a range of growth forecasts for the economy. In 2002, the range for average growth was given as 3¾ to 4¼ percent per year. Our estimate of 4.2 percent is at the upper end of this range.

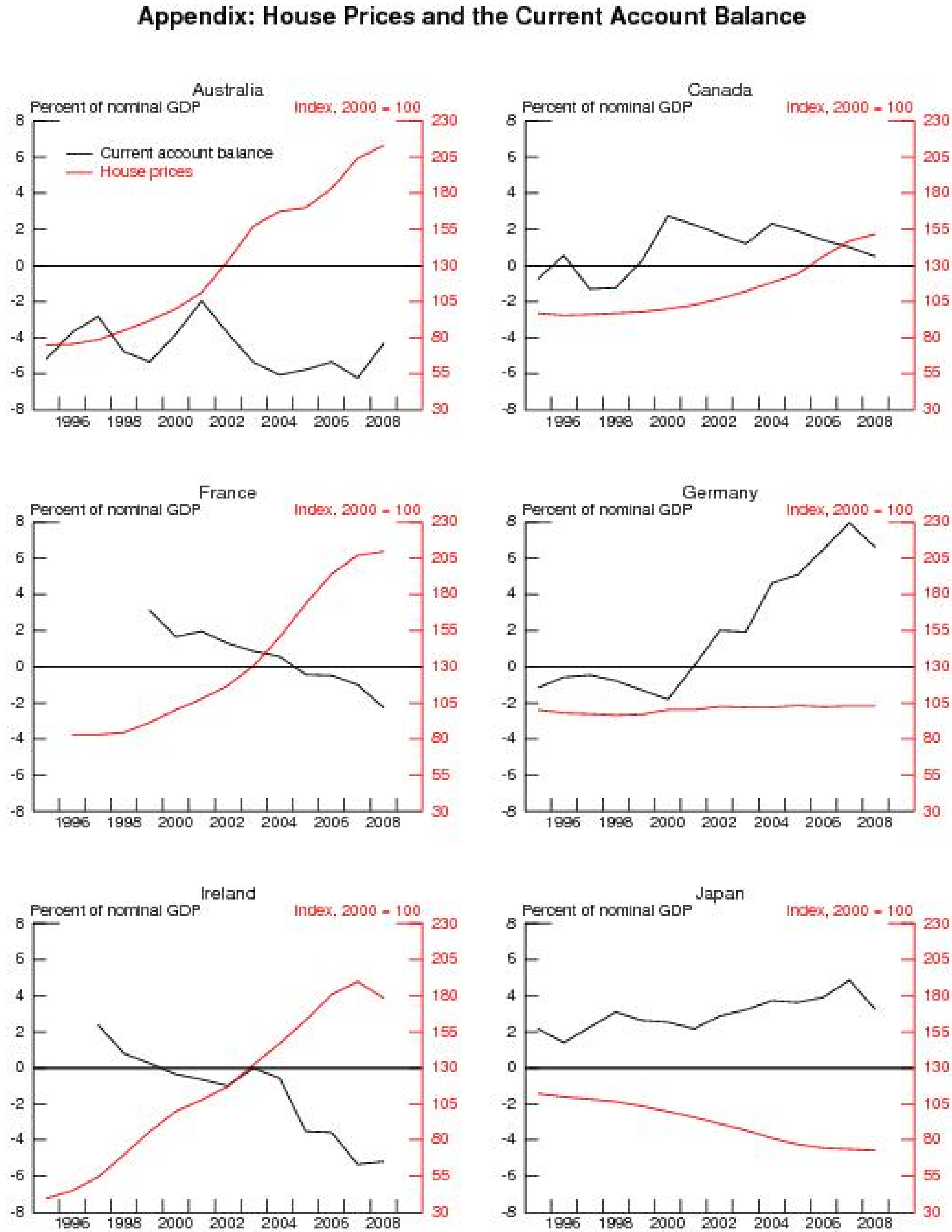
The growth rates for Europe seem less consistent. In the early 2000s, most observers expected relatively slow growth. Forecasts of growth consistently pointed to growth in the low 2 percent range, quite similar to the realized growth rate.

Conclusion

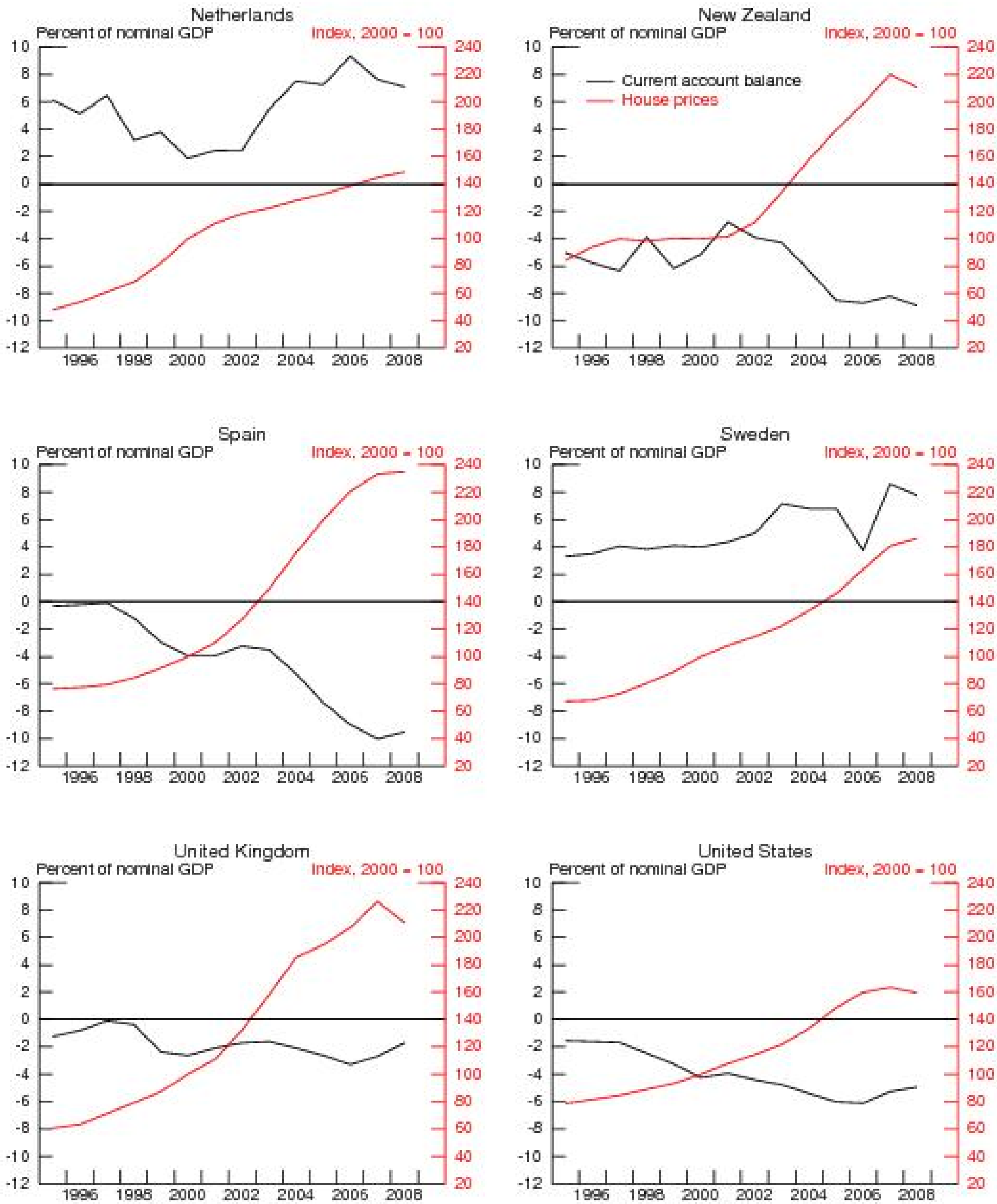
The negative relationship between the current account deficit and the growth rate of house prices is robust across countries and across time. Countries with large current account deficits, on average, experience much faster house price appreciation than countries with current account surpluses. Further, an increase in the current account deficit is also associated with an increase in house price appreciation. The result continues to hold when we compare country pairs: a one percentage point differential in the change in the current account deficit implies about 1.5 percentage points faster house price appreciation.

We find this empirical result is consistent with a real model in which consumption of housing and consumption of other goods are sufficiently complementary. This model, in turn, sheds light on the pattern of current account deficits between Asia, the United States, and Europe. We find that to match both current account balances and house price appreciation in the three regions Asian pessimism alone is not sufficient. We require both Asian pessimism and overly optimistic income growth expectations in Europe and the United States. However, the differences between the necasary and realized growth rates are small and are consistent with normally sized forecasting errors. Indeed, for the United States the necasary growth rate is within the expectations given by the Federal Reserve in its 2002 Monetary Policy Report to Congress.

Appendix: House Prices and Current Accounts



Appendix: House Prices and the Current Account Balance



Appendix: Data

The house price peak dates used to construct chart 3.11 are the following:

Australia 1974Q1, 1981Q2, 1989Q2, 1994Q3; *Belgium* 1979Q3; *Canada* 1976Q4, 1981Q1, 1989Q1; *Denmark* 1979Q2, 1986Q1; *Finland*1989Q2, 2000Q2; *France* 1981Q1, 1991Q1; *Germany* 1974Q1, 1982Q1, 1994Q2; *Ireland* 1979Q2, 1990Q3; *Italy* 1974Q4, 1981Q2, 1992Q2; *Japan* 1973Q4, 1990Q4; *Netherlands* 1978Q2; *New Zealand* 1974Q3, 1983Q1, 1996Q2; *Norway* 1976Q4, 1987Q2; *Spain* 1978Q2, 1991Q4; *Sweden* 1979Q3, 1990Q1; *Switzerland* 1973Q1, 1989Q4; *United Kingdom* 1973Q3, 1980Q3, 1989Q3; *United States* 1973Q4, 1979Q2, 1989Q4

The dates of available data for the scatter plots and the panel regressions are as follows:

	Quarterly Data			
	House Prices		Current Account Balance	
	First Date	Last Date	First Date	Last Date
Australia	1987q2	2009q1	1959q3	2009q1
Canada	1982q1	2009q1	1961q1	2009q1
France	1997q1	2009q1	1999q1	2009q1
Germany	na	na	1971q1	2009q1
Ireland	1976q1	2008q4	1981q1	2009q1
Japan	1956q1	2009q2	1985q1	2009q1
Netherlands	1996q1	2009q1	1982q1	2009q1
Spain	1996q1	2009q1	1990q1	2009q1
Sweden	1987q1	2009q1	1982q1	2009q1
UK	1983q1	2009q1	1955q1	2008q4
US	1975q1	2009q1	1960q1	2009q1

	Annual Data			
	House Prices		Current Account Balance	
	First Date	Last Date	First Date	Last Date
Australia	1988	2008	1960	2008
Canada	1982	2008	1961	2008
France	1997	2008	1999	2008
Germany	1976	2008	1971	2008
Ireland	1976	2008	1997	2008
Japan	1956	2008	1985	2008
Netherlands	1996	2008	1982	2008
Spain	1996	2008	1990	2008
Sweden	1987	2008	1999	2008
UK	1983	2008	1955	2008
US	1975	2008	1960	2008

We use OECD data for the median price and current account plots. The real house price data is quarterly and runs from 1970 to the second quarter of 2009.