Online Appendix:

Conditional Risk Premia in Currency Markets and Other Asset Classes

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Not for Publication

We include in this appendix a number of details and robustness checks that are omitted in the main text for brevity.

A.1. Currency Data: Details

In our benchmark sorting we use bilateral currency excess-returns for 53 countries: Argentina, Australia, Austria, Belgium, Brazil, Canada, Chile, China, Colombia, Czech Republic, Denmark, Egypt, Euro, Finland, France, Germany, Greece, Hong Kong, Hungary, India, Indonesia, Ireland, Israel, Italy, Japan, Jordania, Korea, Kuwait, Malaysia, Mexico, Morocco, The Netherlands, New Zealand, Norway, Pakistan, Peru, Philippines, Poland, Portugal, Russia, Saudi Arabia, Singapore, Sri Lanka, Spain, Sweden, Switzerland, Taiwan, Thailand, Turkey, United Arab Emirates, United Kingdom, Venezuela, and South Africa.

In an alternative sorting we use the bilateral real-dollar currency excess-returns for 23 developed countries: Australia, Austria, Belgium, Canada, Denmark, Euro, Finland, France, Germany, Greece, Hong Kong, Ireland, Italy, Japan, The Netherlands, New Zealand, Norway, Portugal, Singapore, Spain, Sweden, Switzerland, and United Kingdom.

The data construction merges public and private data to obtain the full sample. In our benchmark analysis, sorting currencies into 6 baskets ensures that each portfolio consists of at least 3 currencies over our sample period.[32] We assign the same number of currencies to each basket whenever possible. If the number of currencies is not a multiple of 6, additional currencies are

[32] At the start in January 1974 only 18 currencies are available.

allocated to the corner portfolios 1 and 6 with priority for the high interest rate portfolio 6. The sorted portfolio returns are available in the replication dataset on the journal website.

Our sorting has on average 5.5 currencies in each basket. The average turnover is 29%. We define turnover as the ratio of portfolio switches over the total number of currencies in a basket and take first the average across portfolios and then over time.

Figure A.1 plots the cumulative excess-return of investing 1 dollar on January 1st 1974 in either the low yielding currencies (portfolio 1), the high yielding currencies (portfolio 6A) or the market portfolio. The black vertical lines are months that our definition categorizes as downstates. The high yield currencies strongly outperform the low yield currencies over the sample period.

Table A.1 shows the 10 worst market and carry trade monthly returns. Panel A sorts the 10 worst monthly market excess-returns and then reports the carry trade returns for the same months. Panel B sorts the 10 worst monthly carry trade returns and then reports the market excess-returns for the same months. While a certain degree of idiosyncrasy between market and carry trade returns is to be expected, we overall find that market and carry trade returns co-move over a number of well known adverse economic events: the 1998 crisis, the 2002 bear stock market following the dot.com boom and the 2008 crisis.

We have also verified that our currency sample is exposed to downside risk by sorting individual currency returns on their downside beta. To implement this sorting we first defined downstate observations as those when the market return is below one standard deviation from its sample mean over the period 1974-2010, which is the same definition used in the benchmark results reported in the paper. We then estimated each individual currency return exposure to downside risk (β^-) by running the time series regression in Equation (5). We finally sorted currencies into two basket, high and low downside risk exposure ones, using the median estimated β^- as a cut-off. The high β^- basket has an annualized average log excess return of 2.44% that is higher than the corresponding return of 0.80% for the low β^- basket.[33]

[33]Our sorting uses the full-sample information rather than sorting on pre-formation β^- because downstate observations, by definition, occur with lower frequency in the sample thus rendering pre-formation estimates less reliable.

A.2. Further Robustness Checks

A.2.1. Developed Countries' Currencies

Figure A.2 and Table A.2 document that the DR-CAPM continues to price currencies, commodities, and equities even when only developed countries are included in the currency baskets. This extends the robustness check illustrated in the main body of the paper that the DR-CAPM prices the five baskets of developed currencies returns. The robustness of our results across developing and emerging markets minimizes concerns related to capital controls, default risk, or illiquidity.

A.2.2. Winsorizing

In Figures A.3-A.4 and Tables A.3-A.4 we confirm that our results are not sensitive to outliers in either the market return or the currency returns by in turn winsorizing each set of returns.[34] Figure A.3 and Table A.3 focus only on currencies and show that our results are robust to either winsorizing the currency or the market returns. Figure A.4 and Table A.4 add the commodity portfolios to the test assets and further confirm the stability of the results. Notice that across all these robustness checks, the price of downside risk remains statistically significant and the R^2s are always greater than 55% and in all cases but one greater than 70%. As to be expected, the point estimate of the price of downside risk is further stabilized, even when winsorizing, by the inclusion of other test assets in addition to the currency portfolios.

A.2.3. Inflation Threshold

We explore whether our results are sensitive to the threshold for subdividing high inflation currencies in portfolio 6B. We show consistently that our results are robust but weakened by the inclusion of high inflation currencies. This is not surprising since not only there are concerns on the effective nature of currency returns during periods of economic turmoil, but also in light of the result of Bansal and Dahlquist (2000) that finds high inflation currencies behaving very differently

[34] We winsorize the five worst returns of the market portfolio by replacing them with the sixth worst return for the same portfolio. For the currency portfolios we winsorize the returns by first selecting the months corresponding to the five worst returns for the carry trade and then replacing the returns in those months for each currency portfolio with the sixth worst return in the time series of that portfolio.

from other currencies. We show that high inflation currencies are not as strongly associated with the risk factors and are extremely volatile in sample.

Figure A.5 and Table A.5 present our results using all currencies in portfolio 6. The inclusion of currencies with very high inflation produces prices of risk that are larger than those in our benchmark analysis. This occurs because the high-inflation currencies' returns are less associated with market risk and in particular with downside risk, as shown in the first-stage estimates in the main text, and therefore lower the overall downstate beta of portfolio 6.

For completeness we also report in Figure A.6-A.8 and Table A.6-A.8 the performance of our model across asset classes when portfolio 6 instead of 6A is used in the currency portfolios. All our results are robust to including high inflation countries.

To further highlight the behavior of basket 6B we restrict our attention to the longest sample for which we have a continuos time-series for this basket: June 1980 to March 2010, for a total of 358 observations.

We first establish our benchmark results using portfolios 1-6A on this subsample in Figure A.9 and Table A.9. We find very similar results to our full sample: the DR-CAPM explains over 80% of the variation in returns. These subsample results are not only useful as a starting point for our robustness checks below but also as an independent subsample test. Many existing papers in the currency return literature, in fact, have used a similar starting date (January 1983) for their sample due to data availability. While we view our full sample results, that use more data to overcome the sample limitations in the literature, as an improvement, we also confirm that our results are not driven by the different sample period.

Figure A.10 and Table A.10 present the performance of our model when both basket 6A and 6B are included as test assets; while Figure A.11 and Table A.11 present the results when only basket 6A is included in the estimation and basket 6B is only included in the computation of R^2 and pricing errors. These results highlight that basket 6B is an outlier: it is not as strongly associated with the risk factors but has a high return in sample. Our model correspondingly produces a larger pricing error for this portfolio.

A.2.4. Unrestricted Market Price of Risk

In the main body of the paper all results are presented under the restriction that the market return is exactly priced in each sample. While we discuss in Section 2 of the paper the advantages of imposing such restrictions, we report here the estimates of the unrestricted model on our benchmark test assets of the currency, Fama & French, and commodity portfolios. Figure A.12 and Table A.12 show that the DR-CAPM performs well in its unrestricted form. The estimated price of market risk (λ) is 0.29; an estimate that is close to the value of 0.32 (the same-sample average monthly market log excess return) used in the corresponding restricted estimation. Intuitively, the restricted model performs sufficiently well on the test assets (R^2 of 73.52%) that the unrestricted model finds no need to distort the estimate of the market price of risk in order to fit the same portfolios. The 0.29 estimate is not statistically significant; a fact that should not be surprising in light of the well-known difficulty of accurately estimating the sample average of the market return.

A.2.5. Alternative "Market" Indices

In the main body of the paper the "market" return is approximated by the return on the value-weighted US CRSP index. While we discuss in Section 2.1 of the paper the rational for using such return as a proxy, we verify here that our results are robust to alternative measures of the market return.

In Figure A.13 and Table A.13 we estimate the model based on our own market index. The index is built by equally weighting the returns of the aggregate equity, currency, and commodity market.[35]

In Figure A.14 and Table A.14 we estimate the model based on the MSCI World Equity Market Index return as a proxy for the market return.

Our results are robust to the choice of market index. Using our own composite index the results are little changed from the benchmark estimates reported in the paper. Using the MSCI index the

[35]Hence we equally weight the returns from the value-weighted CRSP equity index, the average return of our currency portfolios and the average return of our commodity portfolios. While we are conscious that equal weights are not necessarily representative of the true weights in the "wealth" portfolio, we find this weighting scheme to be the most transparent in the absence of clear and available weighting schemes for currencies and commodities.

fit is lower mainly due to the lower estimated downside risk of the commodities portfolios, while the fit for currencies and equities is largely unchanged.

A.2.6. Equity Long Sample

Equity market data is available for a longer sample than the data for currencies and commodities. In Figure A.15 and Table A.15 we estimate the DR-CAPM model on the Fama & French portfolios for the period from July 1931 to March 2010. The longer time period increases the number of downstate observations to 110, thus further reducing the estimation uncertainty of first stage downside betas.

The left panel of Figure A.15 and the left column of Table A.15 report that the DR-CAPM can rationalize the cross-sectional dispersion in the returns of the Fama & French portfolios over this longer period. Notice in particular that the pricing error for the small-growth portfolio (portfolio 1) is substantially reduced compared to the estimation on the 1974-2010 sample. While this is in part due to the well-known pattern that the value puzzle is less pronounced in the data before 1960, it does offer further corroborating evidence of the ability of the DR-CAPM to price these returns.

The longer equity sample also allows us to perform further subsample analysis to that possible in the shorter 1974-2010 sample due to the greater number of downstate observations. The right panel of Figure A.15 and the right column of Table A.15 test the model on the subsample from July 1931 to December 1999. The model performs consistently well, thus confirming that our results, at least for equities, are robust to the exclusion of the financial/institutional-investment development of the 2000s and the 2000-1 and 2008 stock market downturns.

A.2.7. Fama & French Small Growth Portfolio

As detailed in the paper, the DR-CAPM does not correctly price the small-growth portfolio (portfolio 1) in the 6 Fama & French portfolios sorted on size and book-to-market. We further document here that a similar pattern occurs when using the 25 Fama & French portfolios sorted on size and book-to-market. Figure A.16 plots the 25 portfolios average excess return against their relative downside betas ($\beta^- - \beta$). Notice that while these returns are broadly positively associated

with the relative downside beta, portfolios 1, 6, and 11 are clear outliers. In fact, these portfolios contain the smallest, second smallest, and third smallest quintiles of growth stocks, respectively. As discussed in the paper, a number of authors have documented that these small-growth portfolios are generally mispriced by asset pricing models (including the Fama & French three-factor model) and have provided reasons why the returns of these portfolios might not be measured accurately.

A.3. Alternative Model Specification

A.3.1. The Ang et al. (2006) specification

In the main text we specified the econometric model to neatly nest CAPM in order to easily highlight the incremental contribution of downside risk. In this section we report that our results do not hinge on this particular specification and are robust to using the empirical specification in Ang et al. (2006).

Ang et al. (2006) specify the model as:

$$\begin{aligned} E[r_i] &= \beta_i^+ \lambda^+ + \beta_i^- \lambda^- \qquad i = 1, \ldots, N, \\ \beta_i^+ &= \frac{cov(r_i, r_m | r_m \geqslant \delta)}{var(r_m | r_m \geqslant \delta)}, \\ \beta_i^- &= \frac{cov(r_i, r_m | r_m < \delta)}{var(r_m | r_m < \delta)}. \end{aligned}$$

The corresponding first-stage regressions are:[36]

$$\begin{aligned} r_{it} &= a_i^+ + \beta_i^+ r_{mt} + \epsilon_{it}^+, \qquad \text{whenever} \quad r_{mt} \geqslant \bar{r}_m - \sigma_{r_m}, \\ r_{it} &= a_i^- + \beta_i^- r_{mt} + \epsilon_{it}^-, \qquad \text{whenever} \quad r_{mt} < \bar{r}_m - \sigma_{r_m}. \end{aligned}$$

[36] Ang et al. (2006) actually use the average market return as a threshold. Here, while we follow their specification, we maintain the lower threshold of one standard deviation below the average market return for consistency with our benchmark analysis.

The second-stage regression is given by:

$$\bar{r}_i = \hat{\beta}_i^+ \lambda^+ + \hat{\beta}_i^- \lambda^- + \alpha_i, \quad i = 1, \ldots, N.$$

Similarly to the case of our benchmark specification, we impose that the market return is exactly priced in sample. In the present setting this implies that: $\bar{r}_m = \lambda^+ + \lambda^-$, because for the market $\beta_m^+ = \beta_m^- = 1$. By substituting this relationship in the second stage regression one obtains:

$$\bar{r}_i = \hat{\beta}_i^+ \bar{r}_m + (\hat{\beta}_i^- - \hat{\beta}_i^+)\lambda^- + \alpha_i, \quad i = 1, \ldots, N.$$

Subsequent tables for the estimation of this equation report the estimated λ^- as well as the sample value of the average market excess return for which, consistently with the notation in the draft, we use the symbol λ. Notice that the estimates of λ^- in this specification are not comparable to those in the main text. The value of λ^+ implied by the imposed restriction on the market return can be recovered from the tables by computing $\lambda^+ = \lambda - \lambda^-$.

We briefly note that the performance of our model is robust to this change in specification. We leave the detailed results for all asset classes for the reader to explore in Tables A.16-A.19 and Figures A.17-A.20.

In Figure A.21 and Table A.20 we further check the robustness of our benchmark results to variations in the threshold for the downstate by dividing the state-space into three regions: upstate, midstate, and downstate. The three regions are defined by the descending thresholds of the sample average of the market return, plus or minus 0.5 standard deviations. We present results both using the currency portfolios 1-6A and using jointly the currency portfolios and the 6 Fama & French equity portfolios sorted on size and book-to-market.

The model can jointly explain the cross-section of both currency and equity returns. Similarly to our benchmark case, we find a high and statistically significant price of risk for the downstate. However, we find only mixed results for the price of risk of the midstate and upstate. When we estimate the model using only currencies we find, as expected, a monotonically increasing price of risk from the upstate to the downstate. The same, however, is not true for the model jointly

estimated on equities and currencies where the midstate has a lower price of risk than the upstate.

A.4. Principal Component Analysis on Currency, Equity, and Commodity Portfolios

We include here the loadings of the principal component analysis (PCA) performed jointly on the currency, equity and commodity portfolios that is omitted in the main text for brevity. In Table A.21 the loadings of the first three principal components reveal that they can be interpreted as level factors for equities, commodities, and currencies respectively. These three components explain 75% of the time series variation of these portfolios.

A.5. Other Models of Currency Returns

In the main draft we compared our model to the leading principal component analysis (PCA) based models in the literature. For completeness, in this section we also report results for the extension of the Durable Consumption CAPM (DC-CAPM) that Lustig and Verdelhan (2007) applied to currencies (in addition to the PCA-based model of Lustig et al. (2011)) and the co-skewness model of Harvey and Siddique (2000).

We estimate the DC-CAPM model employing the two stage procedure of Fama and MacBeth (1973). We use monthly personal consumption expenditures on durables and non-durables and services from FRED and the same market excess-return as in our DR-CAPM estimation. Tables A.22 and A.23 summarize the performance of the models by Lustig and Verdelhan (2007) and Lustig et al. (2011) on our sample. Consistent with the previous evidence we find that the DC-CAPM fits the cross section of currency returns.[37] Across asset classes, the model produces R^2 that are generally higher than those of PCA-based model, but the estimated prices of risk are often not statistically significant.

Figure A.22 and Table A.24 estimate the Co-Skewness CAPM of Harvey and Siddique (2000):

$$\bar{r}_i = \hat{\beta}_i \lambda + \hat{\beta}_i^{coskew} \lambda^{coskew} + \alpha_i, \quad i = 1, \ldots, N,$$

[37]However, note the debate in Burnside (2011b) and Lustig and Verdelhan (2011) on the statistical robustness of the association of currency returns with consumption growth in the first-stage regression of the DC-CAPM.

where,

$$\hat{\beta}_i^{coskew} = \frac{E[\varepsilon_{i,t+1}\varepsilon_{m,t+1}^2]}{\sqrt{E[\varepsilon_{i,t+1}^2]}E[^2_{m,t+1}]}$$
$$\varepsilon_{i,t+1} = r_{i,t+1} - a_i - \beta_i r_{m,t+1}$$

We find that the model does not rationalize our benchmark test assets composed of the Fama & French, currency, and commodity portfolios. Figure A.22 shows that the hardest portfolios for the model to price are the commodity futures portfolios.

Appendix References

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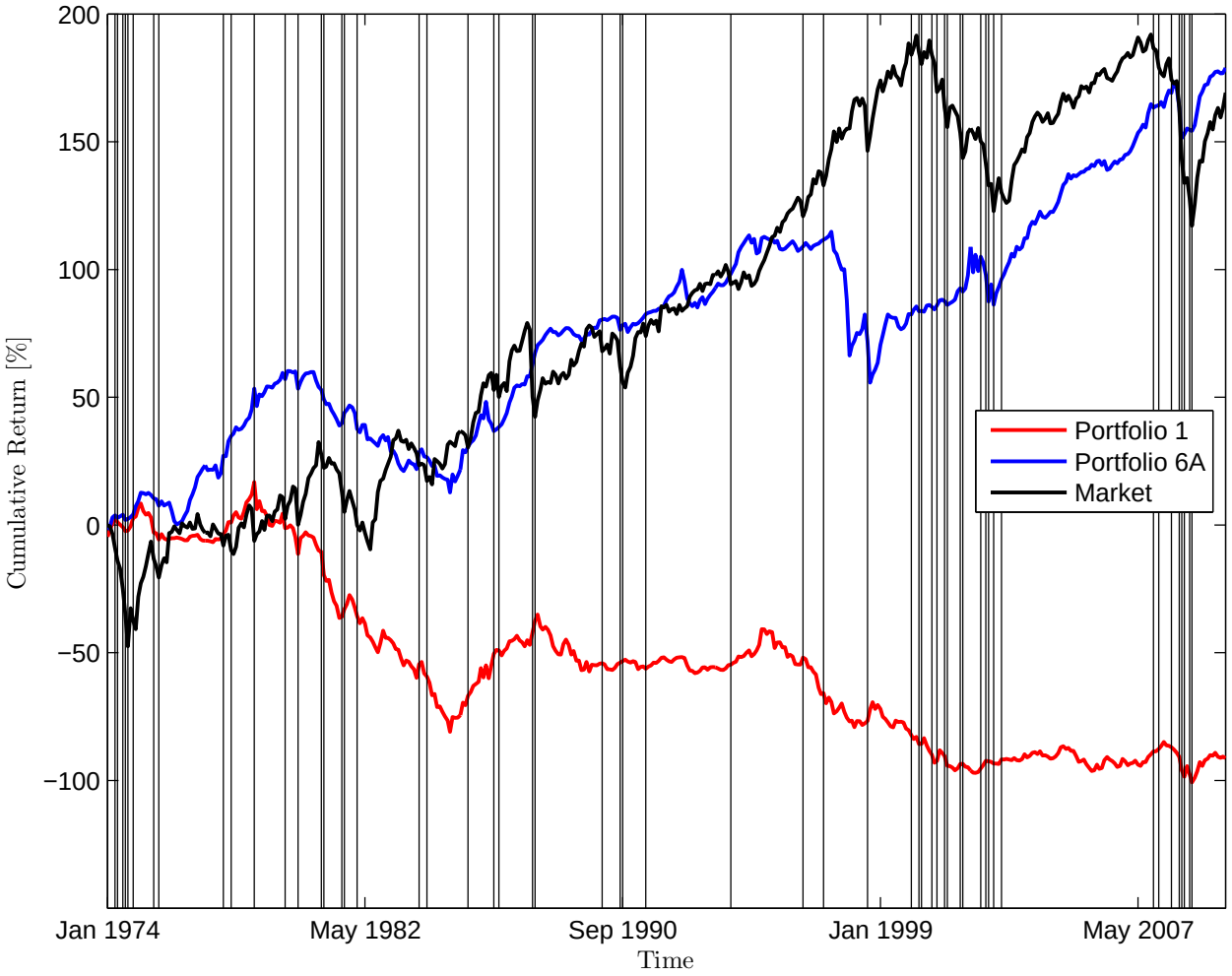
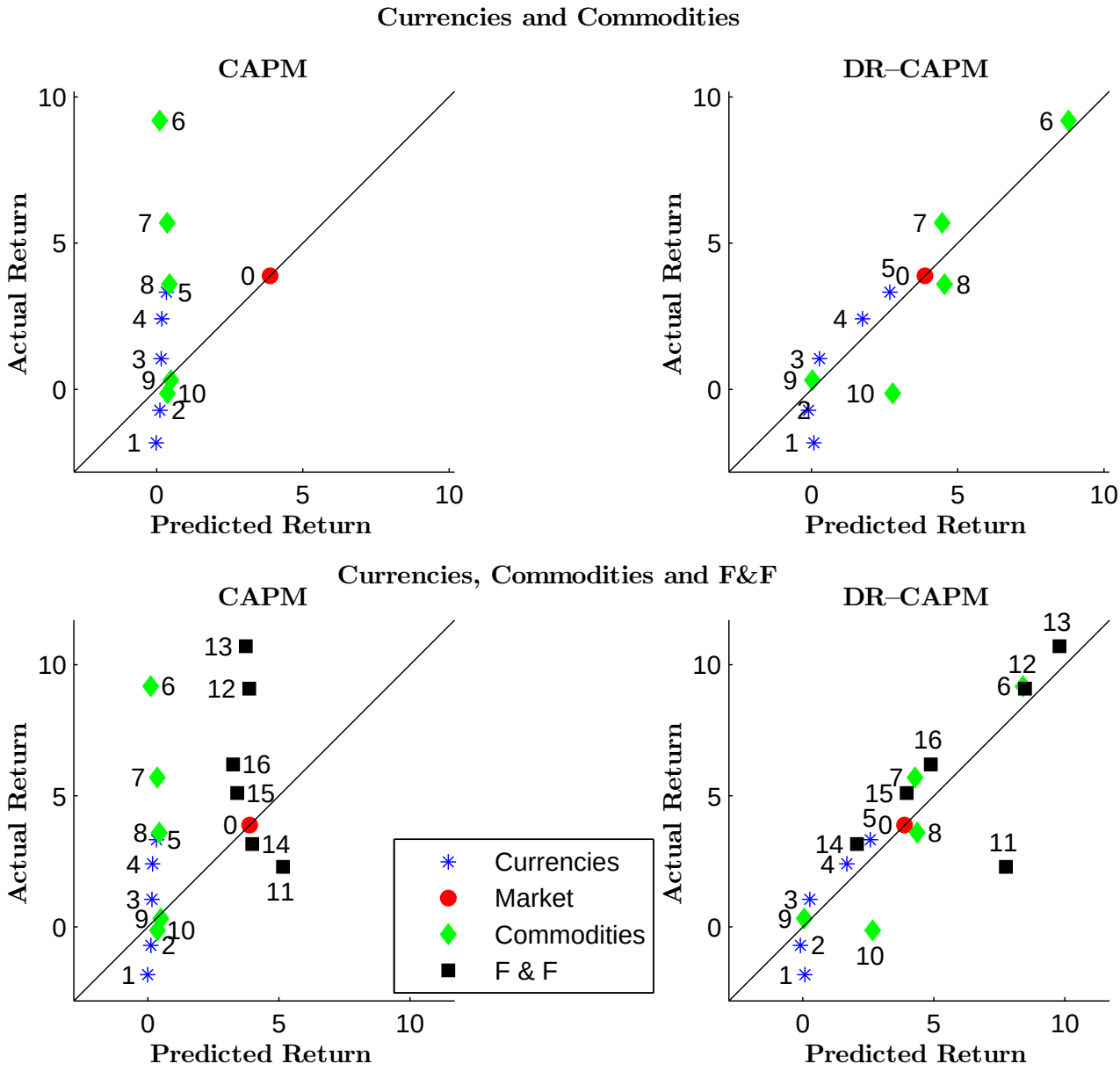
Lustig, H. and A. Verdelhan (2011). The cross section of foreign currency risk premia and consumption growth risk: reply. *American Economic Review 101*(7), 3477–3500.

Figure A.1. **Cumulative Market and Carry Trade Returns**



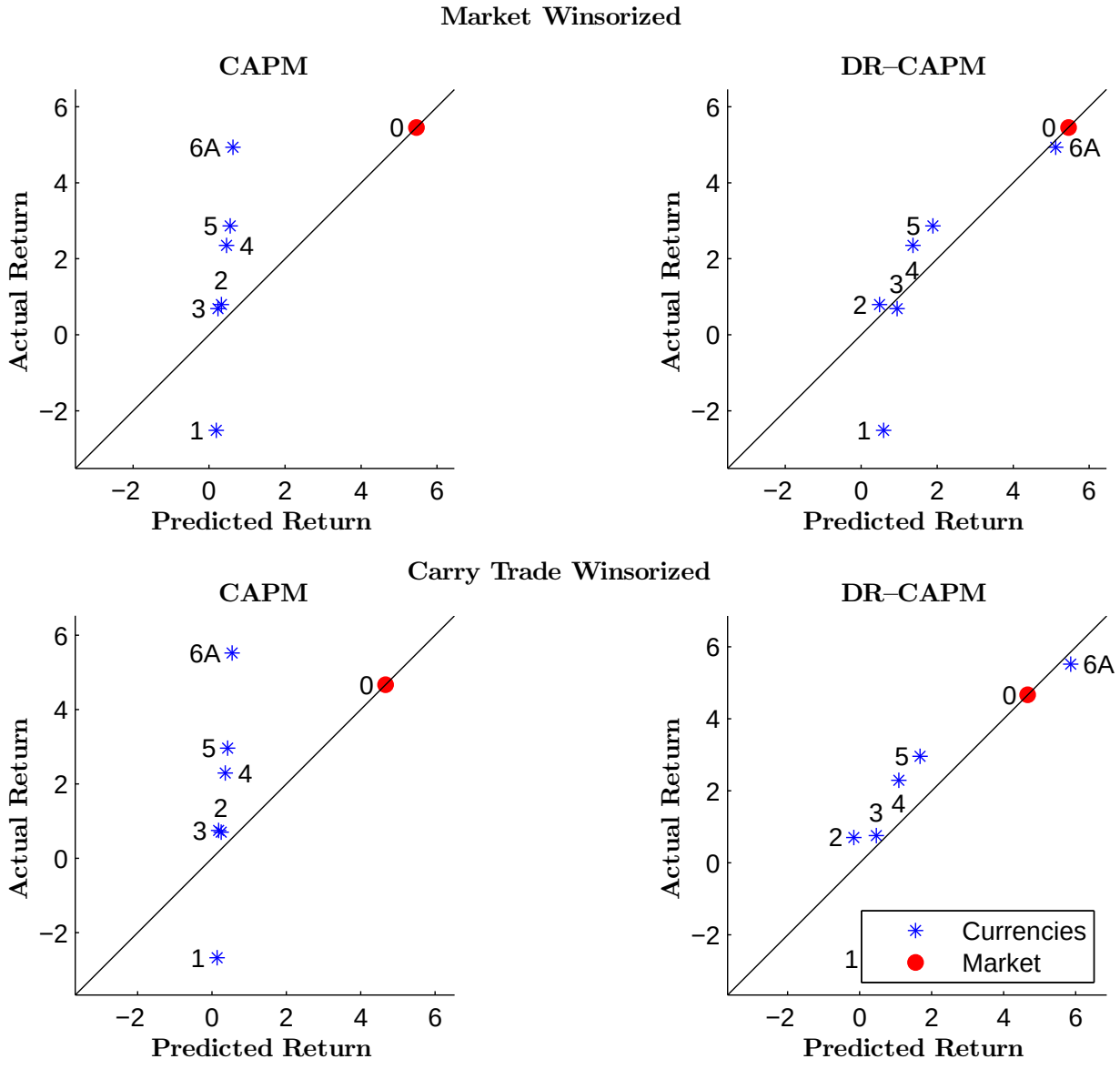
Cumulative excess-return of investing 1 dollar in January 1974 in the low yield currencies (portfolio 1), the high yield currencies (portfolio 6A) and the market excess-return. The proceeds are reinvested on a monthly basis. The sample period is January 1974 to March 2010 for a total of 435 observations. High inflation countries in the last portfolio are excluded. A country is considered to have high inflation if it has annualized monthly inflation 10% higher than US inflation. The black vertical lines indicate months in which the market return is more than one standard deviation below its sample mean.

Figure A.2. **Model Robustness: Developed Currencies, Equities, and Commodities**



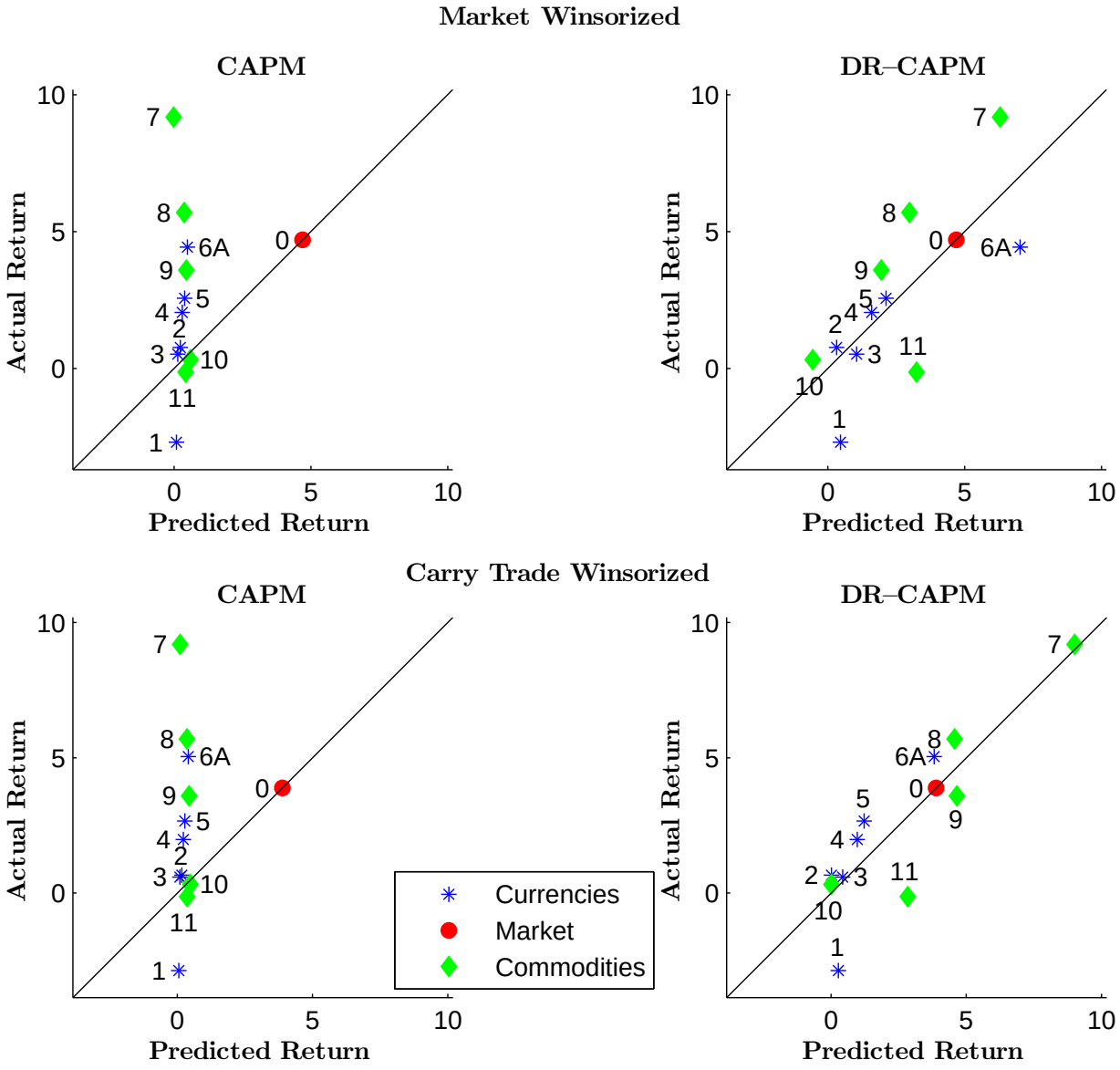
Annualized mean excess-returns versus the predicted excess-returns in percent for the unconditional CAPM in the left panels and the downside risk CAPM (DR-CAPM) in the right panels for five developed currency portfolios (1-5), monthly re-sampled based on the interest rate differential with the US, five commodity futures portfolios monthly re-sampled based on basis (6-10) as well as six Fama & French portfolios sorted on size and book-to-market (11-16). The market excess-return is included as a test asset (0). The sample period is January 1974 to December 2008 for a total of 420 observations.

Figure A.3. **Model Robustness: Currencies. Winsorized**



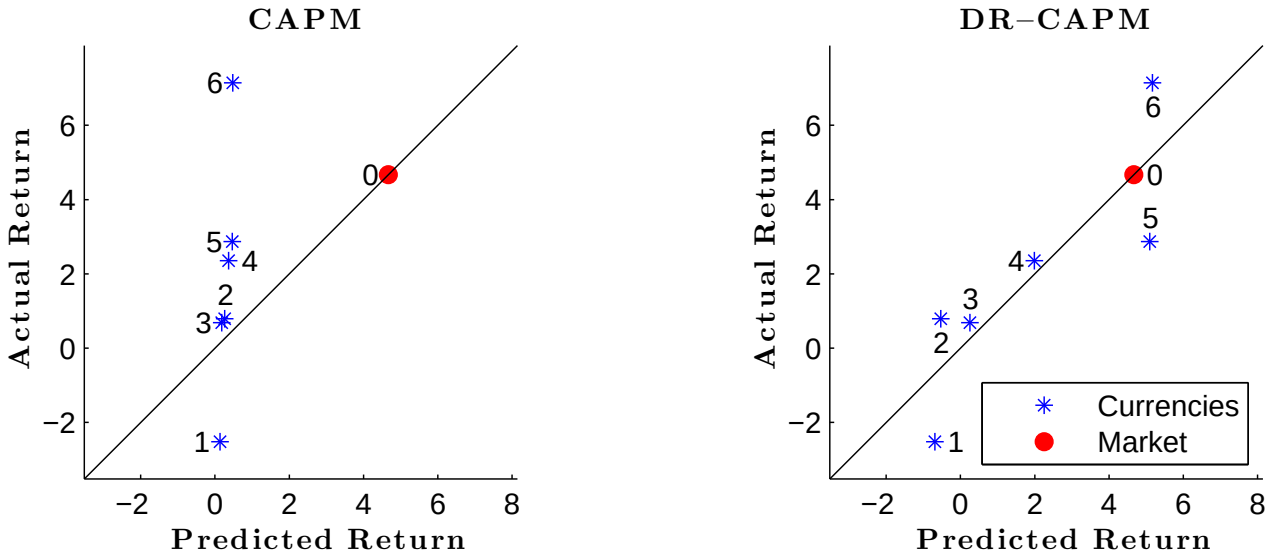
Annualized mean excess-returns versus the predicted excess-returns in percent for the unconditional CAPM in the left panels and the downside risk CAPM (DR-CAPM) in the right panels for six currency portfolios (1-6A), monthly re-sampled based on the interest rate differential with the US. The market excess-return is included as a test asset (0). The sample period is January 1974 to March 2010 for a total of 435 observations. High inflation countries in the last portfolio are excluded. A country is considered to have high inflation if it has an annualized monthly inflation of 10% higher than US inflation. The top two panels winsorize the worst 5 market excess returns and the bottom two panels winsorize the currency portfolio returns for the worst 5 carry trade returns.

Figure A.4. **Model Robustness: Currencies and Commodities. Winsorized**



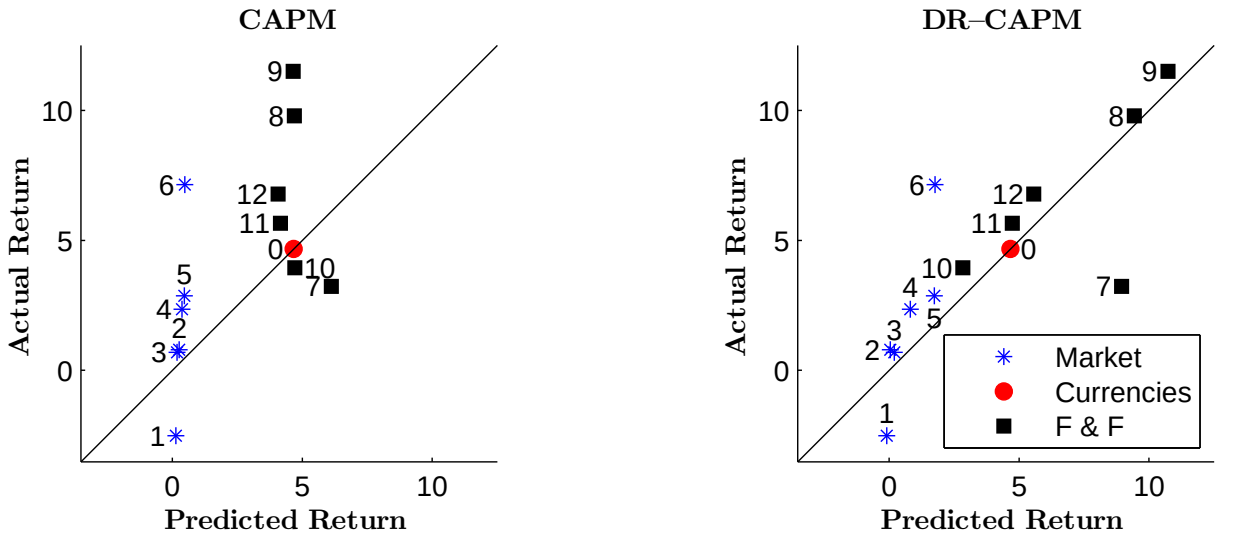
Annualized mean excess-returns versus the predicted excess-returns in percent for the unconditional CAPM in the left panels and the downside risk CAPM (DR-CAPM) in the right panels for six currency portfolios (1-6A), monthly re-sampled based on the interest rate differential with the US and five commodity futures portfolios monthly re-sampled based on basis (7-11). The market excess-return is included as a test asset (0). The sample period is January 1974 to December 2008 for a total of 420 observations. High inflation countries in the last portfolio are excluded. A country is considered to have high inflation if it has an annualized monthly inflation of 10% higher than US inflation. The top two panels winsorize the worst 5 market excess returns and the bottom two panels winsorize the currency portfolio returns for the worst 5 carry trade returns.

Figure A.5. **Model Robustness: Currencies. All Countries**



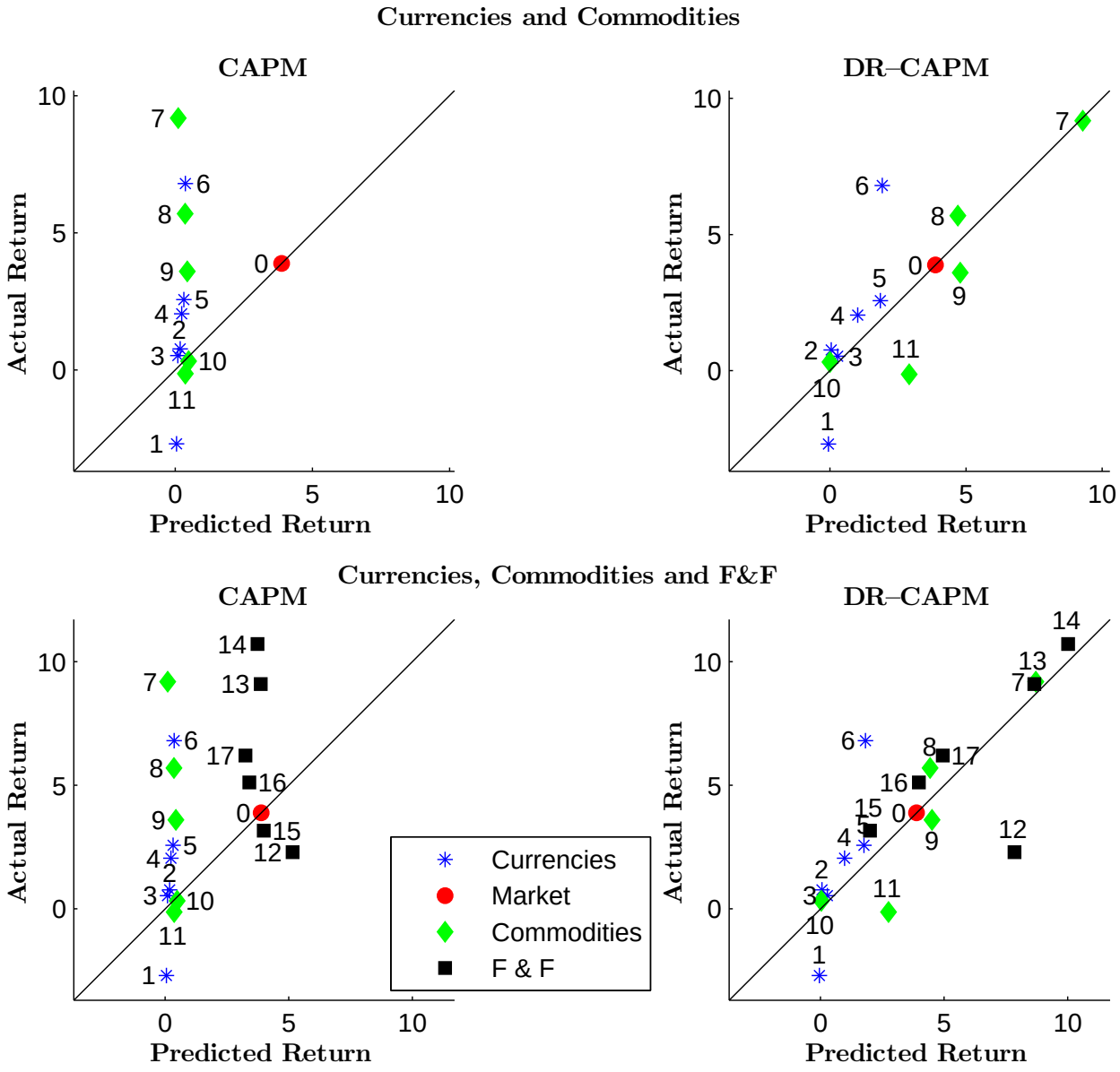
Annualized mean excess-returns versus the predicted excess-returns in percent for the unconditional CAPM in the left panel and the downside risk CAPM (DR-CAPM) in the right panel. Test assets are six currency portfolios (1-6), monthly re-sampled based on the interest rate differential with the US. The market excess-return is included as a test asset (0) The sample period is January 1974 to March 2010 for a total of 435 observations.

Figure A.6. **Model Robustness: Currencies and Equities. All Countries**



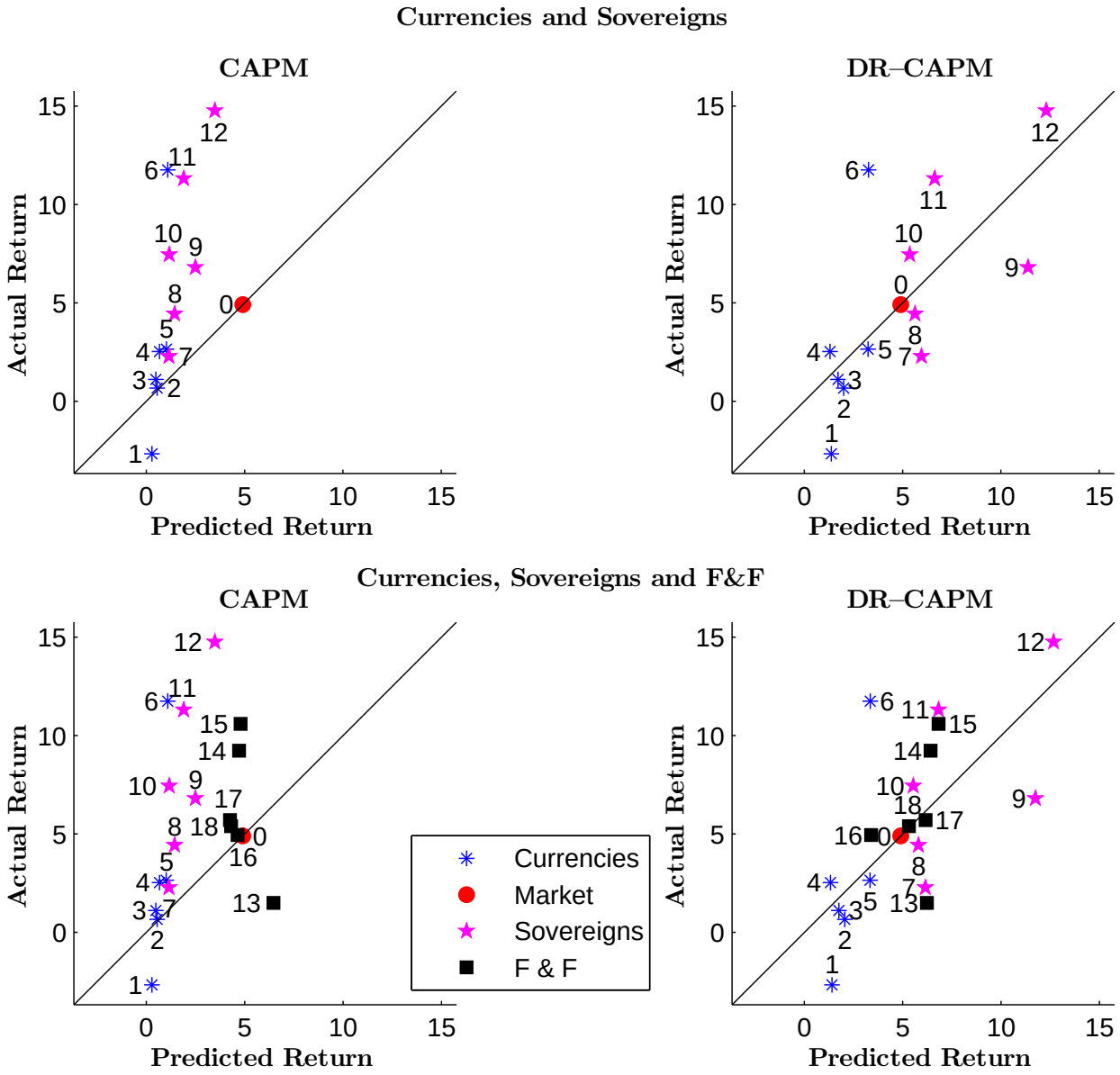
Annualized mean excess-returns versus the predicted excess-returns in percent for the unconditional CAPM in the left panel and the downside risk CAPM (DR-CAPM) in the right panel. Test assets are six currency portfolios (1-6), monthly re-sampled based on the interest rate differential with the US and the six Fama & French portfolios sorted on size and book-to-market (7-12). The market excess-return is included as a test asset (0). The sample period is January 1974 to March 2010 for a total of 435 observations.

Figure A.7. **Model Robustness: Currencies, Equities and Commodities. All Countries**



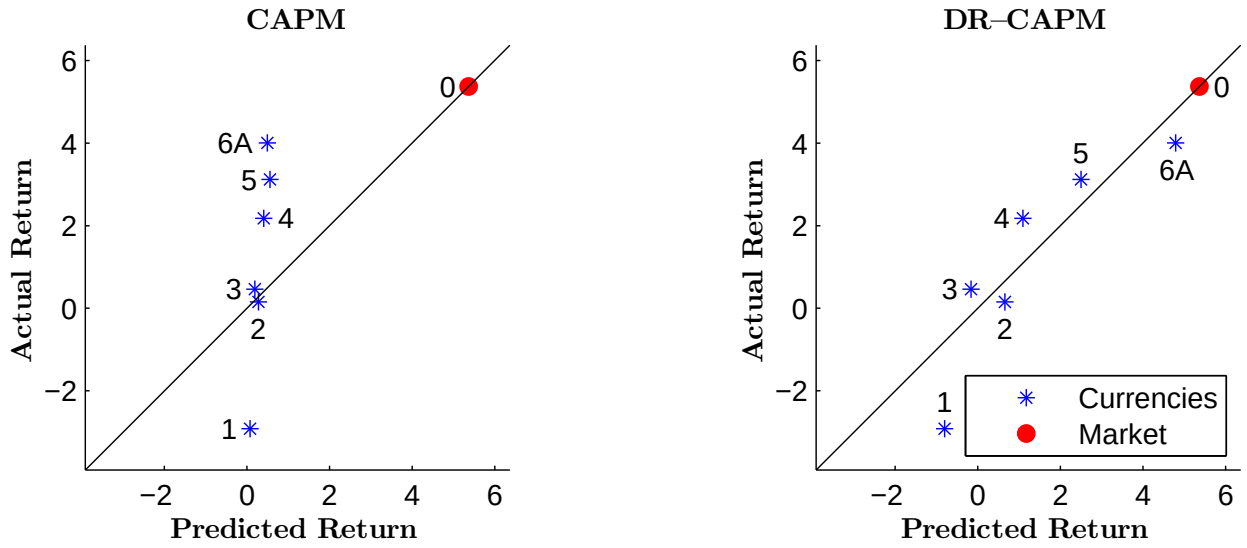
Annualized mean excess-returns versus the predicted excess-returns in percent for the unconditional CAPM in the left panels and the downside risk CAPM (DR-CAPM) in the right panels. Test assets are six currency portfolios (1-6), monthly re-sampled based on the interest rate differential with the US, five commodity futures portfolios monthly re-sampled based on the commodity basis (7-11), and the six Fama & French portfolios sorted on size and book-to-market (12-17). The market excess-return is included as a test asset (0). The sample period is January 1974 to December 2008 for a total of 420 observations.

Figure A.8. **Model Robustness: Currencies, Equities, and Sovereigns. All Countries**



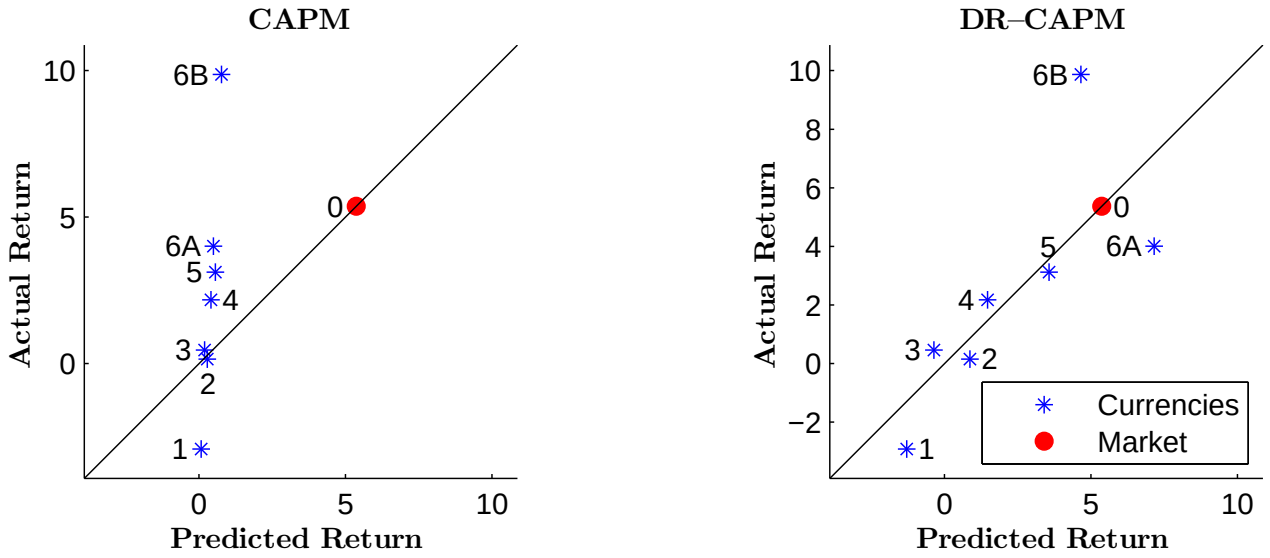
Annualized mean excess-returns versus the predicted excess-returns in percent for the unconditional CAPM in the left panels and the downside risk CAPM (DR-CAPM) in the right panels. Test assets are six currency portfolios (1-6), monthly re-sampled based on the interest rate differential with the US, six sovereign bond portfolios (7-12), monthly re-sampled based on their probability of default and bond beta, and the six Fama & French (7-13) portfolios sorted on size and book-to-market. The market excess-return is included as a test asset (0). The sample period is January 1995 to March 2010 for a total of 183 observations.

Figure A.9. **Model Robustness: Currencies. Subsample**



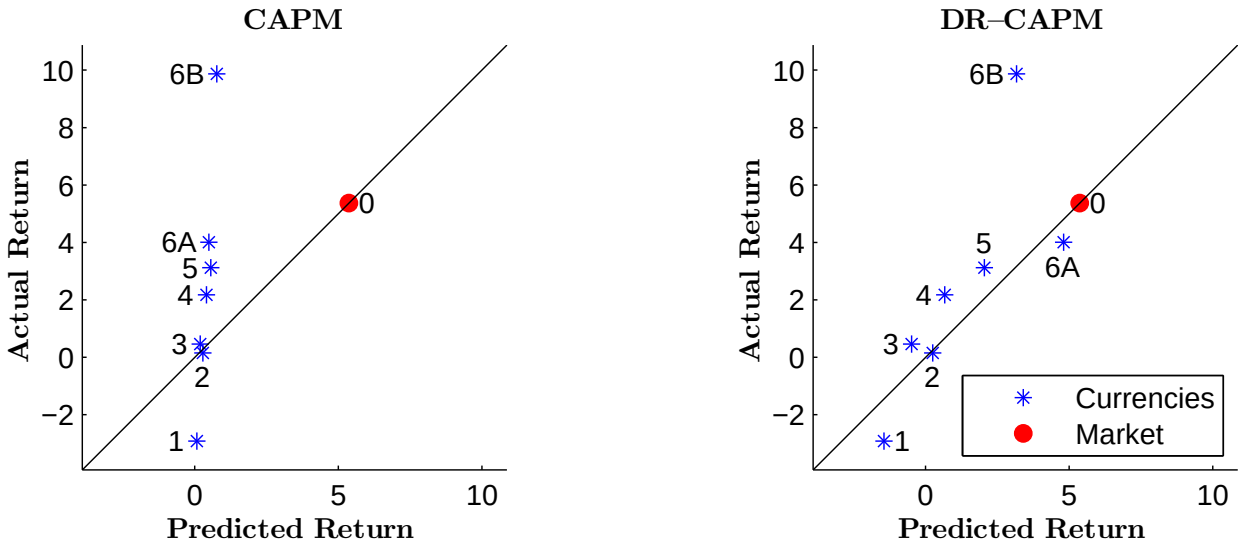
Annualized mean excess-returns versus the predicted excess-returns in percent for the unconditional CAPM in the left panel and the downside risk CAPM (DR-CAPM) in the right panel. Test assets are six currency portfolios (1-6A), monthly re-sampled based on the interest rate differential with the US. The sample period is June 1980 to March 2010 for a total of 358 observations. High inflation countries in the last portfolio are excluded. The market excess-return in included as a test asset (0). A country is considered to have high inflation if it has annualized monthly inflation 10% higher than US inflation.

Figure A.10. **Model Robustness: Currencies, Including basket 6B, Subsample**



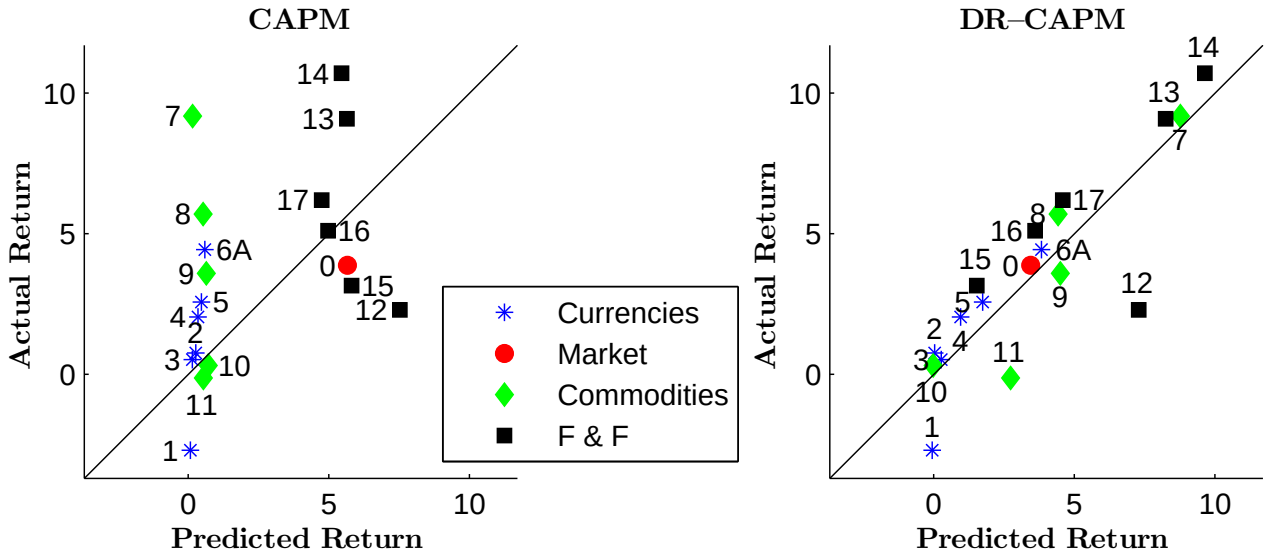
Annualized mean excess-returns versus the predicted excess-returns in percent for the unconditional CAPM in the left panel and the downside risk CAPM (DR-CAPM) in the right panel. Test assets are seven currency portfolios (1-5, 6A, 6B). Currencies are first sorted into 6 baskets monthly based on their interest rate differential with the US. Then high inflation countries in the sixth portfolio are subdivided into basket 6B. A country is considered to have high inflation if it has annualized monthly inflation 10% higher than US inflation. The remaining countries in basket 6 are labelled 6A. The market excess-return in included as a test asset (0). The sample period is January 1974 to March 2010 for a total of 435 observations.

Figure A.11. **Model Robustness: Currencies. Estimated on Baskets 1-6A, Basket 6B Included Only in the Fit. Subsample**



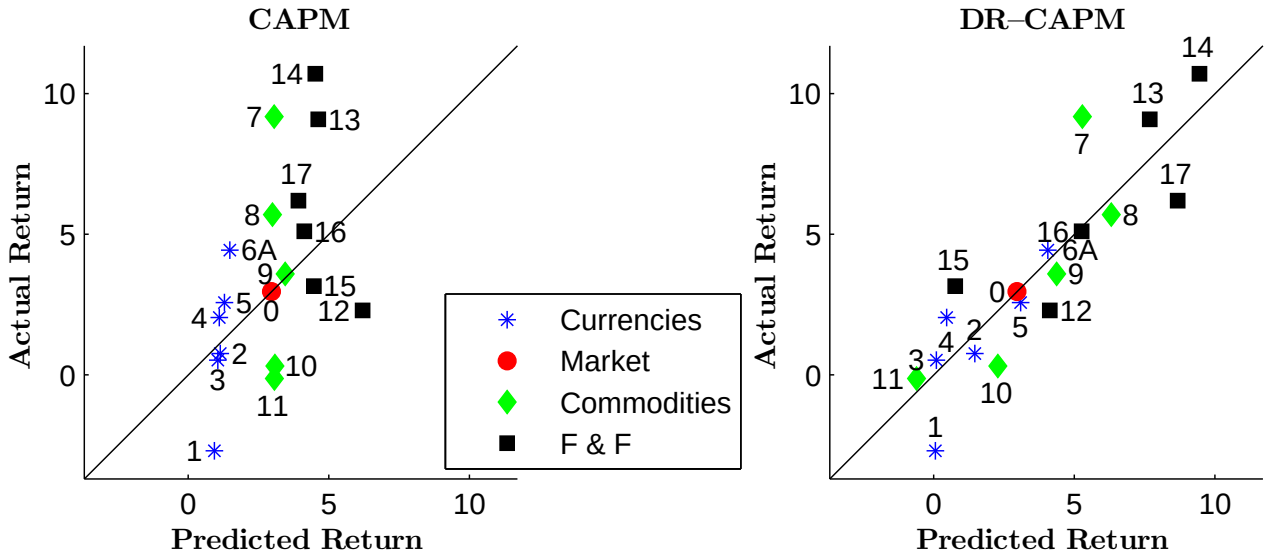
Annualized mean excess-returns versus the predicted excess-returns in percent for the unconditional CAPM in the left panel and the downside risk CAPM (DR-CAPM) in the right panel. Test assets are seven currency portfolios (1-5, 6A, 6B). Currencies are first sorted into 6 baskets monthly based on their interest rate differential with the US. Then high inflation countries in the sixth portfolio are subdivided into basket 6B. A country is considered to have high inflation if it has annualized monthly inflation 10% higher than US inflation. The remaining countries in basket 6 are labelled 6A. The models are estimated using the currency baskets 1-6A, then basket 6-B is included in the figure to asses its fit. The market excess-return in included as a test asset (0). The sample period is June 1980 to March 2010 for a total of 358 observations.

Figure A.12. **Model Robustness: Currencies, Commodities, and Equities. Unrestricted Estimation**



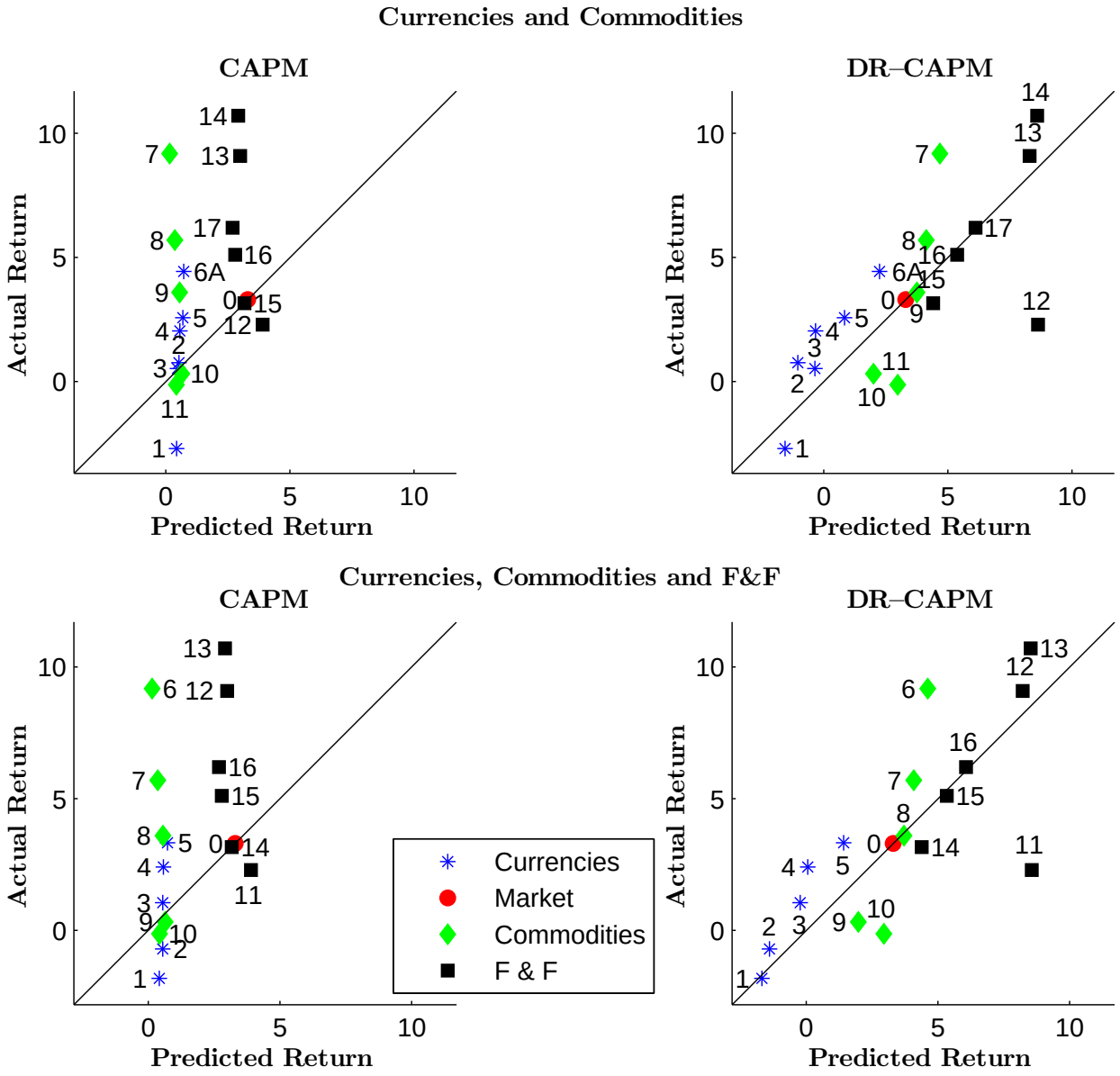
Annualized mean excess-returns versus the predicted excess-returns in percent for the unconditional CAPM in the left panels and the downside risk CAPM (DR-CAPM) in the right panels for six currency portfolios (1-6A), monthly re-sampled based on the interest rate differential with the US, five commodity futures portfolios monthly re-sampled based on basis (labelled 7-11) as well as six Fama & French portfolios sorted on size and book-to-market (labelled 12-17). The market excess-return is included as a test asset (0). The sample period is January 1974 to December 2008 for a total of 420 observations. High inflation countries in the last portfolio are excluded. A country is considered to have high inflation if it has an annualized monthly inflation of 10% higher than US inflation.

Figure A.13. **Model Robustness: Currencies and Commodities. Composite Market Return Index**



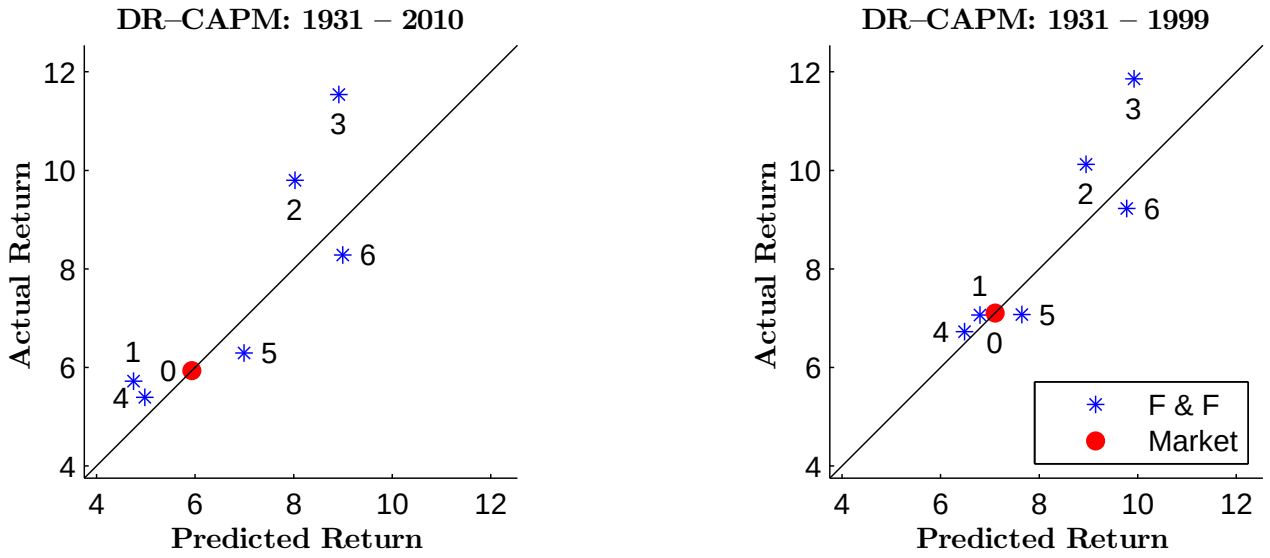
Annualized mean excess-returns versus the predicted excess-returns in percent for the unconditional CAPM in the left panels and the downside risk CAPM (DR-CAPM) in the right panels for six currency portfolios (1-6A), monthly re-sampled based on the interest rate differential with the US, five commodity futures portfolios monthly re-sampled based on basis (labelled 7-11) as well as six Fama & French portfolios sorted on size and book-to-market (labelled 12-17). The market excess-return is included as a test asset (0). The market excess-return is the equally weighted mean of the CRSP value weighted excess return, the mean of the 6 currency portfolio excess returns and the mean of the 5 commodity portfolios. The sample period is January 1974 to December 2008 for a total of 420 observations. High inflation countries in the last portfolio are excluded. A country is considered to have high inflation if it has an annualized monthly inflation of 10% higher than US inflation.

Figure A.14. **Model Robustness: Currencies, Equities, and Commodities. MSCI World Equity Market Index**



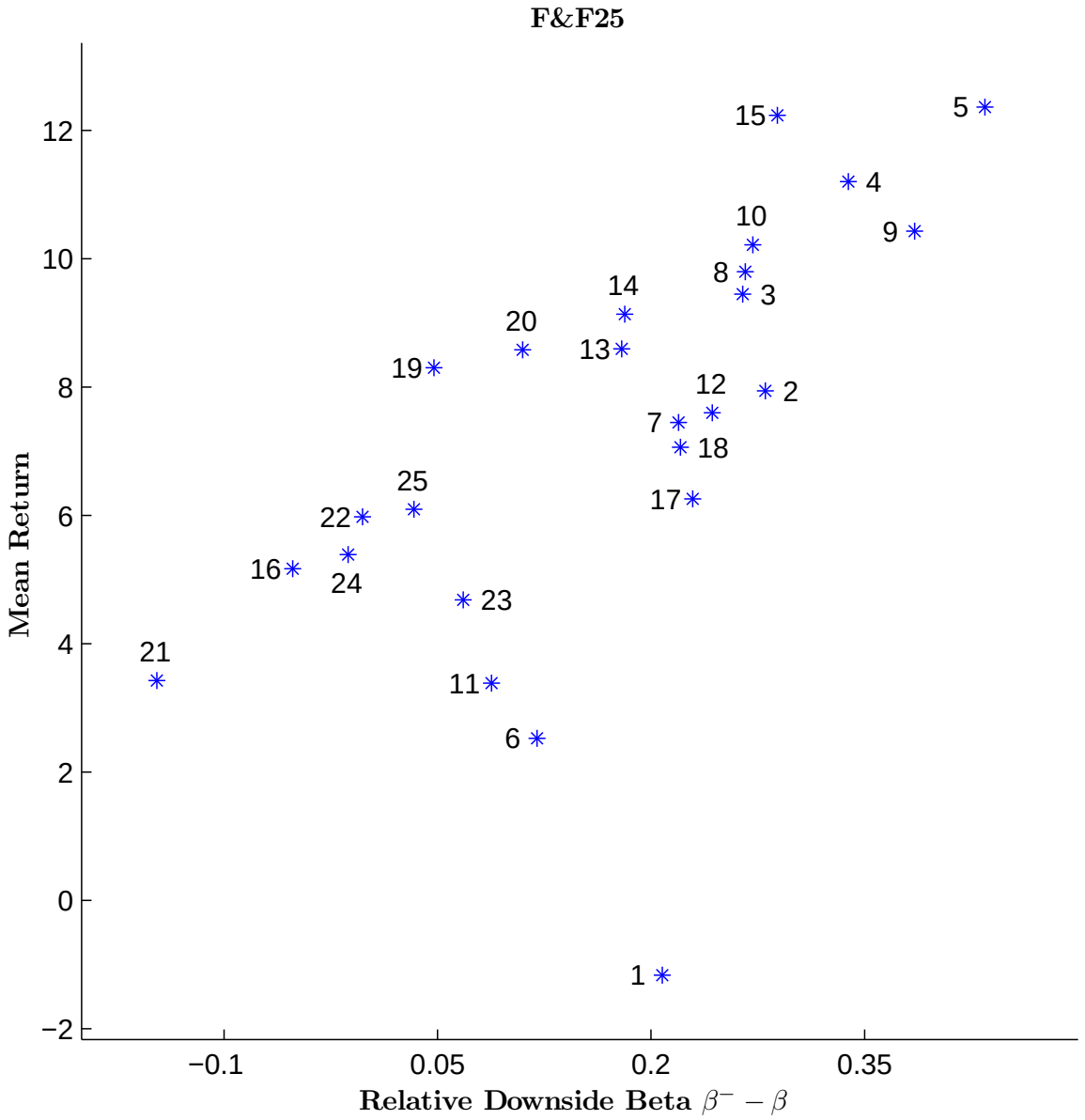
Annualized mean excess-returns versus the predicted excess-returns in percent for the unconditional CAPM in the left panels and the downside risk CAPM (DR-CAPM) in the right panels. In the top panels, test assets are six currency portfolios (labelled 1-6A), monthly re-sampled based on the interest rate differential with the US, five commodity futures portfolios monthly re-sampled based on basis (labelled 7-11) as well as six Fama & French portfolios sorted on size and book-to-market (labelled 12-17). In the bottom panels, test assets are five currency portfolios of developed countries(labelled 1-5), monthly re-sampled based on the interest rate differential with the US, five commodity futures portfolios monthly re-sampled based on basis (labelled 6-10) as well as six Fama & French portfolios sorted on size and book-to-market (labelled 11-16). A country is considered to have high inflation if it has an annualized monthly inflation of 10% higher than US inflation. The market excess-return is included as a test asset (0). The sample period is January 1974 to December 2008 for a total of 420 observations. High inflation countries in the last portfolio are excluded.

Figure A.15. **Model Robustness: Equities. Long Sample: 1931-2010**



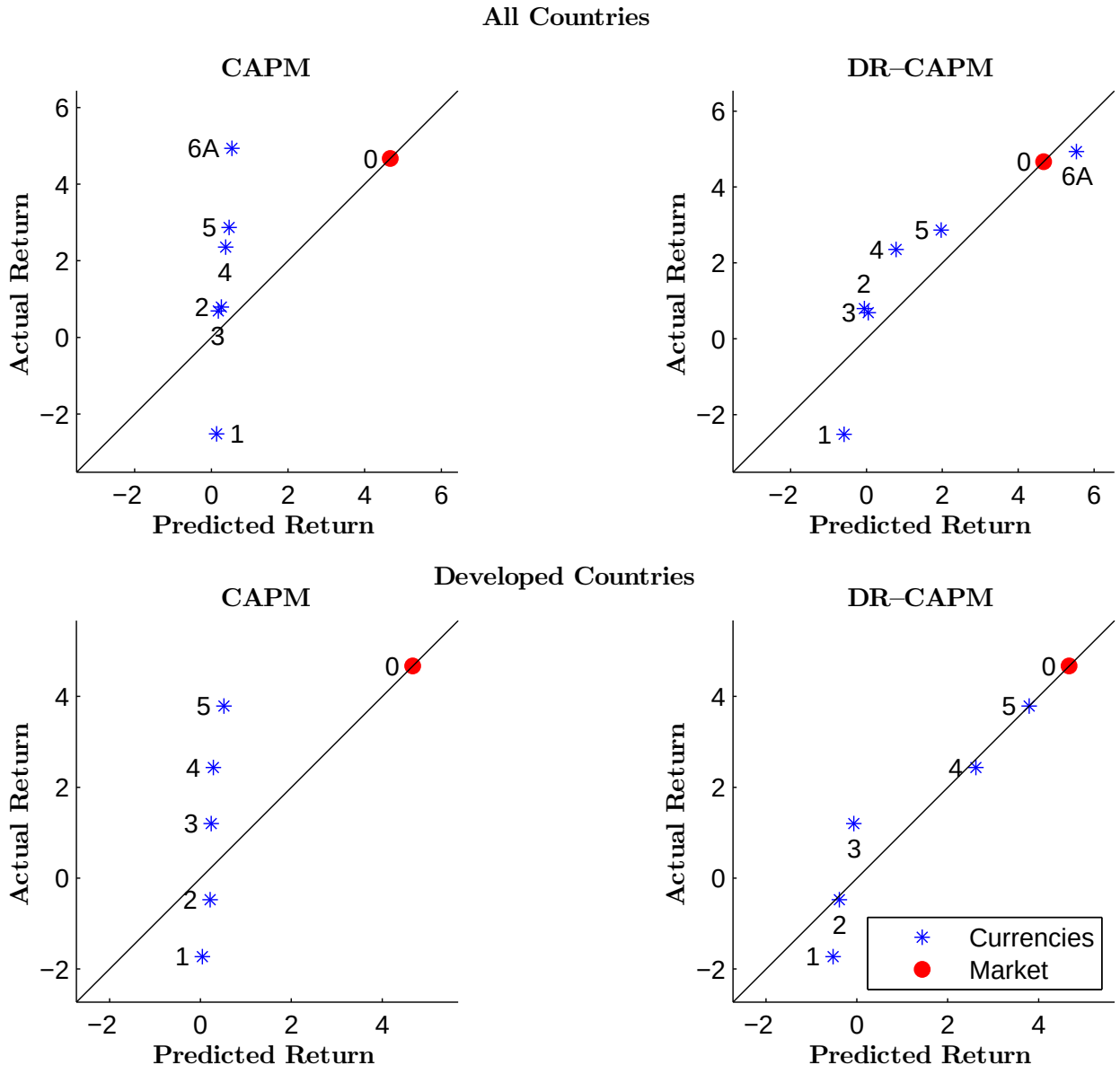
Annualized mean excess-returns versus the predicted excess-returns in percent for the downside risk CAPM (DR-CAPM). Test assets are six Fama & French equity portfolios sorted on size and book-to-market (1-6). The market excess-return is included as a test asset (0). The sample period is July 1931 to March 2010 in the left panel and to December 1999 in the right panel for a total of 945 and 822 observations, respectively.

Figure A.16. **Risk-Return Relations: 25 Fama & French Portfolios**



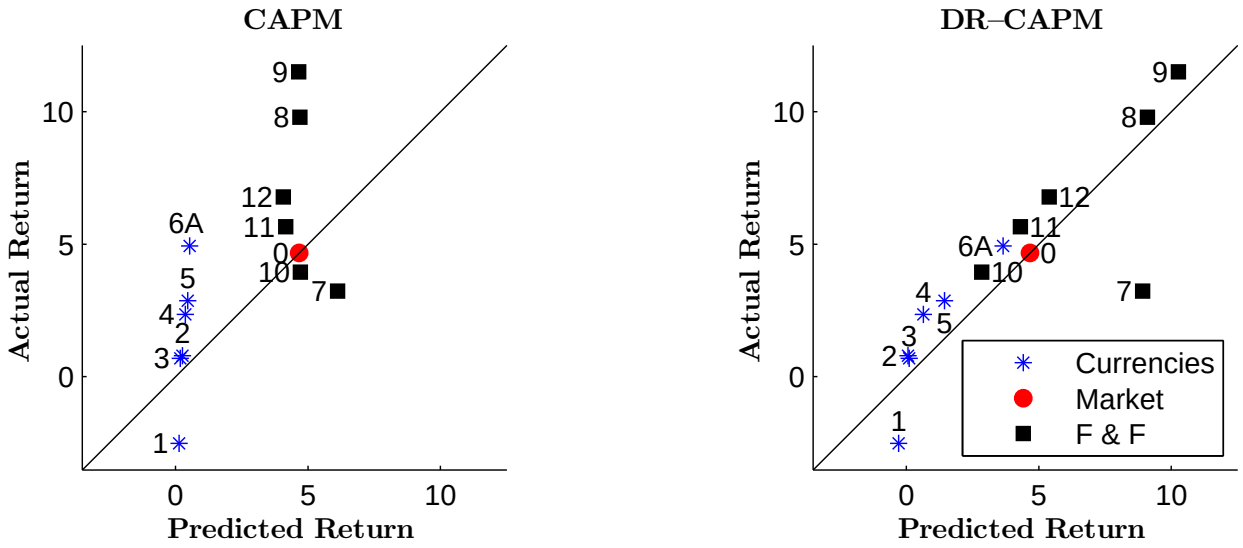
Risk-return relations for twenty-five Fama & French equity portfolios sorted on size and book-to-market. The figure plots the realized mean excess-return versus the relative downside betas ($\beta^- - \beta$). The sample period is January 1974 to March 2010 for a total of 435 observations.

Figure A.17. **Model Robustness: Currencies. Alternative Specification**



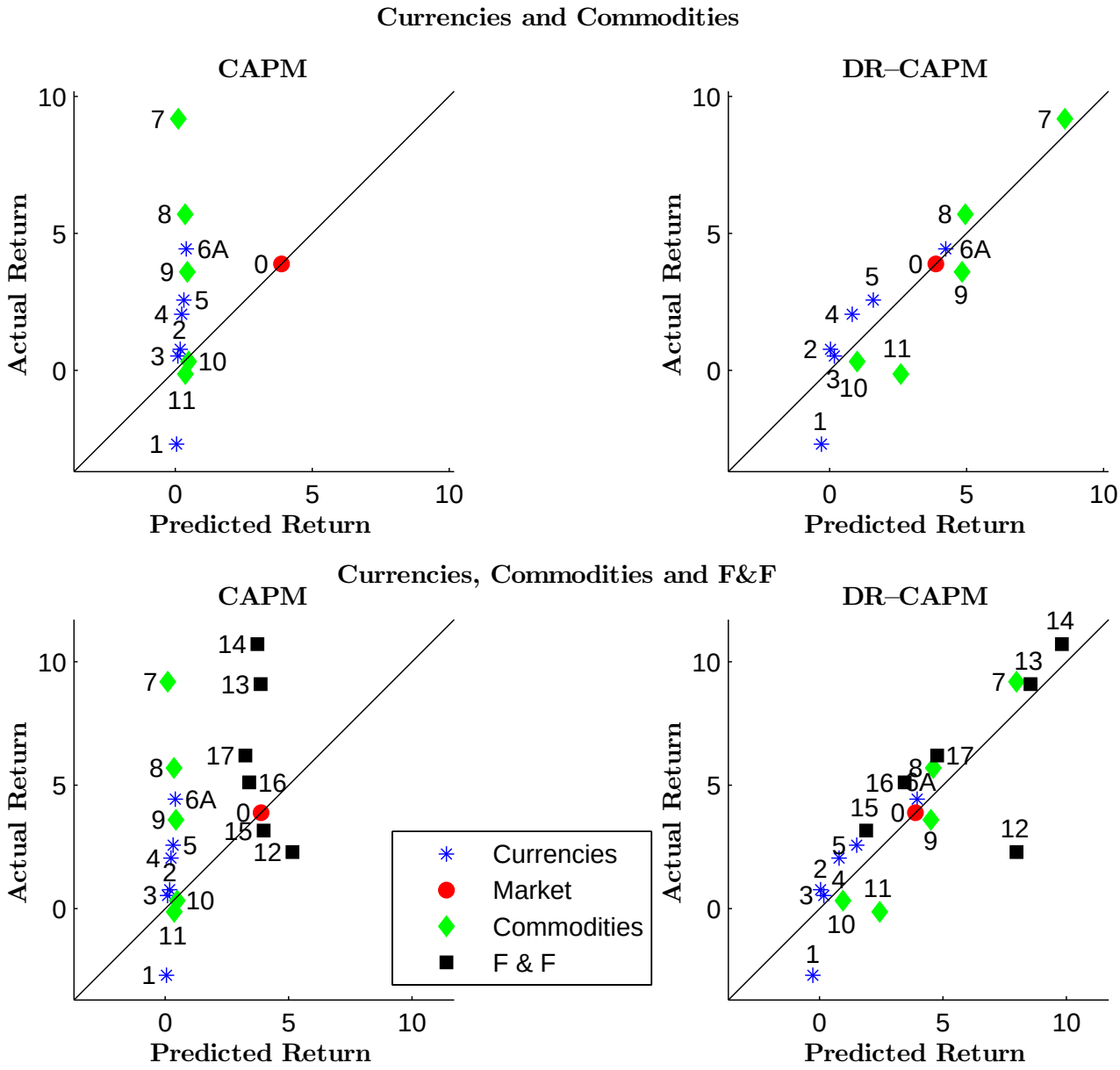
Annualized mean excess-returns versus the predicted excess-returns in percent for the unconditional CAPM in the left panel and the downside risk CAPM (DR-CAPM) in the right panel. In the top panel, test assets are six currency portfolios (1-6A), monthly re-sampled based on the interest rate differential with the US. High inflation countries in the last portfolio are excluded. A country is considered to have high inflation if it has annualized monthly inflation 10% higher than US inflation. In the bottom panel, test assets are five currency portfolios of developed countries. The market excess-return is included as a test asset (0). The sample period is January 1974 to March 2010 for a total of 435 observations.

Figure A.18. **Model Robustness: Currencies and Equities. Alternative Specification**



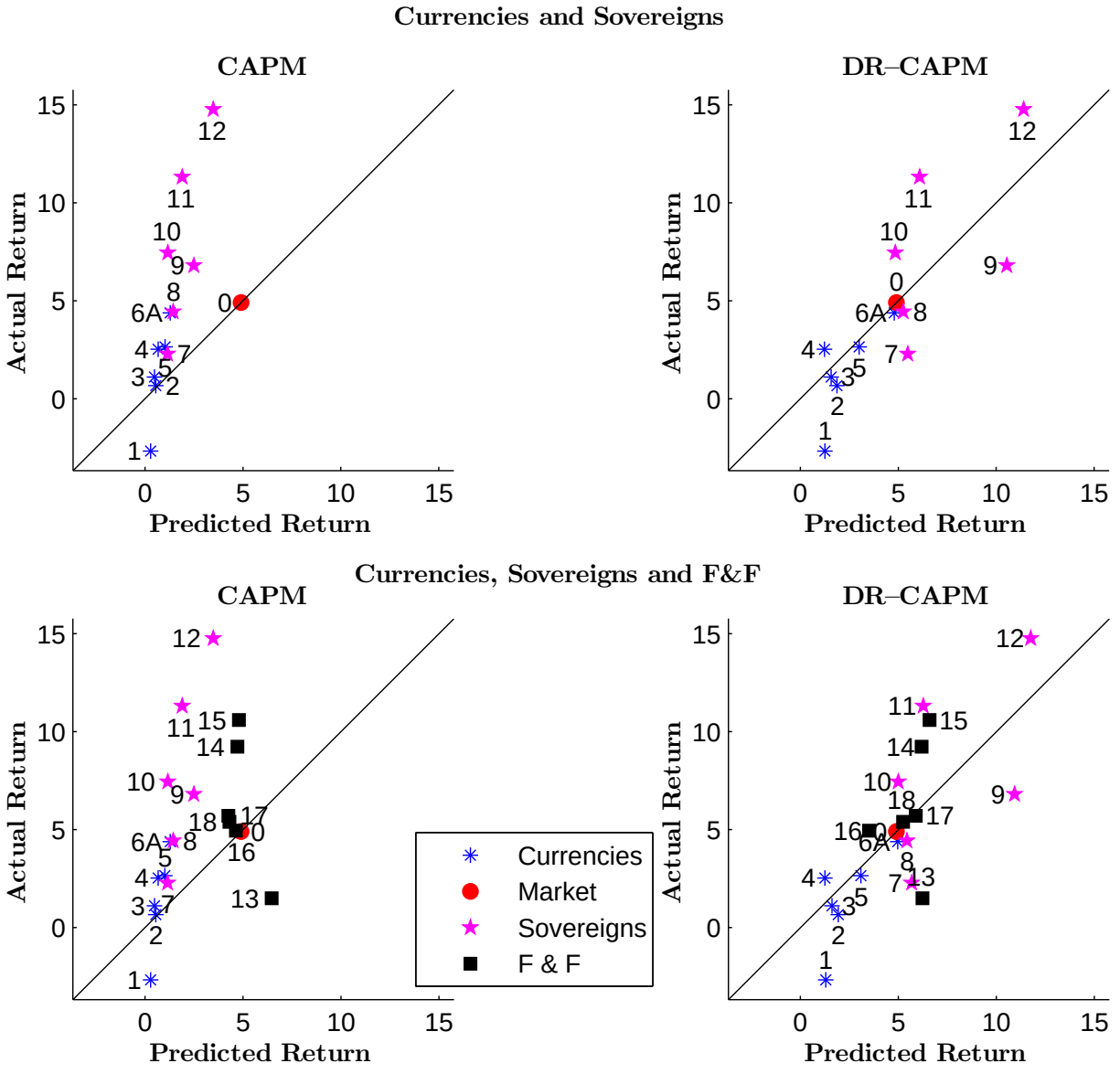
Annualized mean excess-returns versus the predicted excess-returns in percent for the unconditional CAPM in the left panels and the downside risk CAPM (DR-CAPM) in the right panels. Test assets are six currency portfolios (1-6A), monthly re-sampled based on the interest rate differential with the US as well as the six Fama & French portfolios sorted on size and book-to-market (7-12). The market excess-return is included as a test asset (0). The sample period is January 1974 to March 2010 for a total of 435 observations. High inflation countries in the last currency portfolio are excluded. A country is considered to have high inflation if it has annualized monthly inflation 10% higher than US inflation.

Figure A.19. **Model Robustness: Currencies, Equities, and Commodities. Alternative Specification**



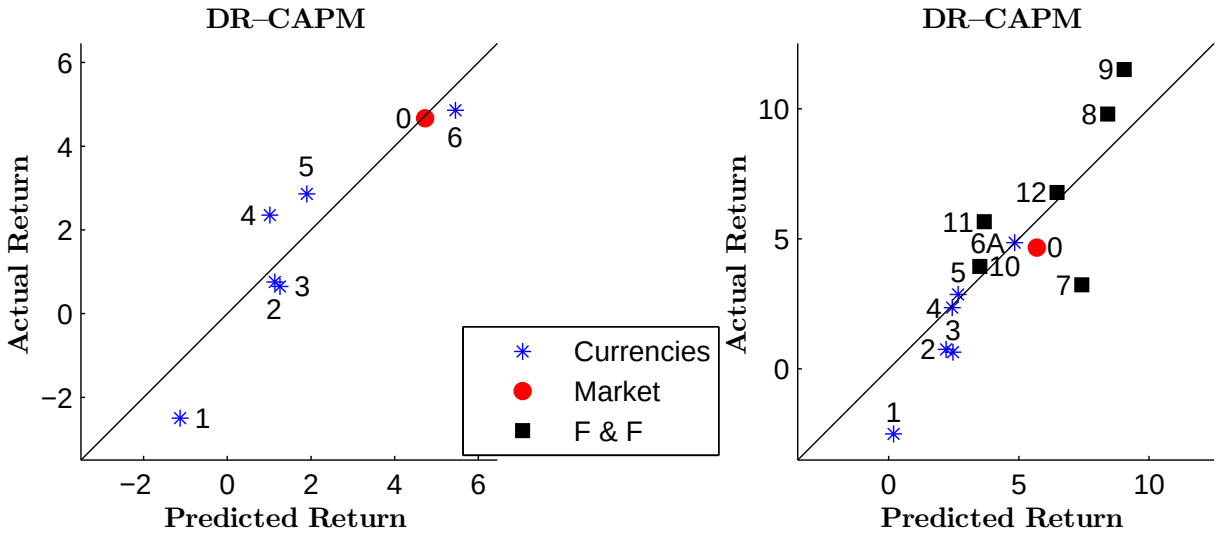
Annualized mean excess-returns versus the predicted excess-returns in percent for the unconditional CAPM in the left panels and the downside risk CAPM (DR-CAPM) in the right panels for six currency portfolios (1-6A), monthly re-sampled based on the interest rate differential with the US, five commodity futures portfolios monthly re-sampled based on basis (7-11) as well as six Fama & French portfolios sorted on size and book-to-market (12-17). The market excess-return is included as a test asset (0). The sample period is January 1974 to December 2008 for a total of 420 observations. High inflation countries in the last portfolio are excluded. A country is considered to have high inflation if it has an annualized monthly inflation of 10% higher than the US.

Figure A.20. **Model Robustness: Currencies, Equities, and Sovereign Bonds. Alternative Specification**



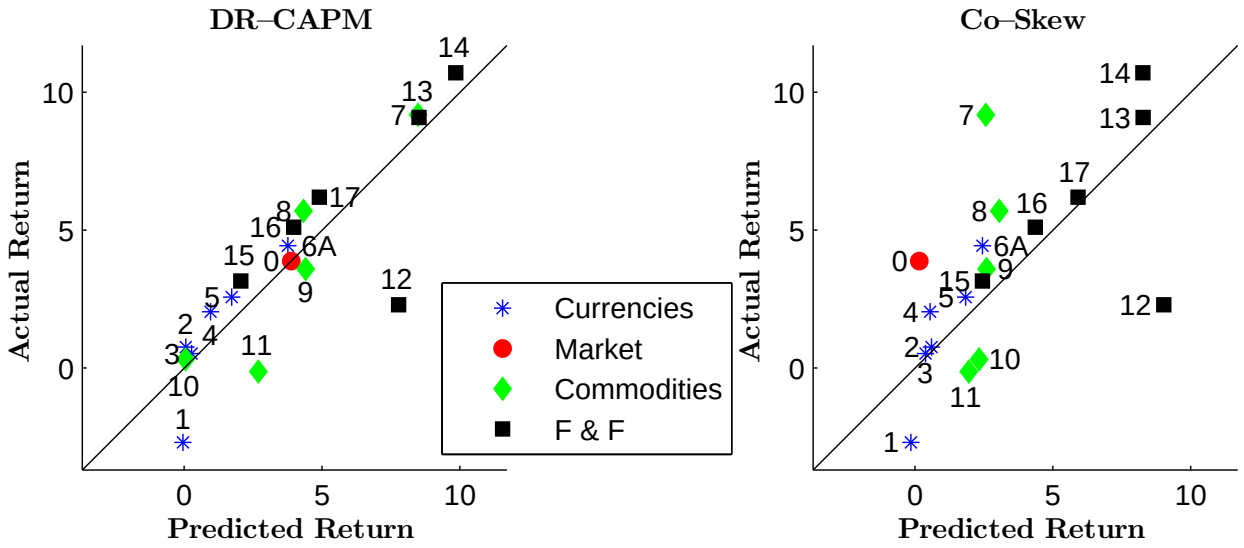
Annualized mean excess-returns versus the predicted excess-returns in percent for the unconditional CAPM in the left panels and the downside risk CAPM (DR-CAPM) in the right panels for six currency portfolios (1-6A), monthly re-sampled based on the interest rate differential with the US, six sovereign bond portfolios monthly re-sampled based on their probability of default and bond beta (7-12) as well as six Fama & French portfolios sorted on size and book-to-market (13-18). The market excess-return is included as a test asset (0). The sample period is January 1995 to March 2010 for a total of 183 observations. High inflation countries in the last portfolio are excluded. A country is considered to have high inflation if it has an annualized monthly inflation of 10% higher than the US inflation.

Figure A.21. **Model Robustness: Currencies. Three States**



Annualized mean excess-returns versus the predicted excess-returns in percent for the three-state downside risk CAPM (DR-CAPM). Test assets are six currency portfolios (1-6A), monthly re-sampled based on the interest rate differential with the US. The right panel also includes the six Fama & French portfolios (7-12) sorted on size and book-to-market as test assets. The sample period is January 1974 to March 2010 for a total of 435 observations. The market excess-return is included as a test asset (0). High inflation countries in the last currency portfolio are excluded. A country is considered to have high inflation if it has annualized monthly inflation 10% higher than US inflation. Downstates (upstates) are all months in which the market return is more than 0.5 standard deviation below (above) its sample mean with intermediate states defined as all remaining observations.

Figure A.22. **Model Comparison: Currencies, Equities, and Commodities**



Annualized mean excess-returns versus the predicted excess-returns in percent for the downside risk CAPM (DR-CAPM) in the left panels and the Co-Skewness CAPM (Co-Skew) in the right panels for six currency portfolios (1-6A), monthly re-sampled based on the interest rate differential with the US, five commodity futures portfolios monthly re-sampled based on basis (labelled 7-11) as well as six Fama & French portfolios sorted on size and book-to-market (labelled 12-17). The market excess-return is included as a test asset (0). The sample period is January 1974 to December 2008 for a total of 420 observations. High inflation countries in the last portfolio are excluded. A country is considered to have high inflation if it has an annualized monthly inflation of 10% higher than US inflation.

Table A.1. **Worst Returns for Market and Carry Trade**

Panel A: the 10 worst monthly market excess-returns and the carry trade returns for the same months. Panel B: the 10 worst monthly carry trade returns and the market excess returns for the same months. The sample period is January 1974 to March 2010 for a total of 435 observations.

	Worst	2	3	4	5	6	7	8	9	10th Worst
	Panel A. 10 Worst Month for Market Excess-Return									
Date	10/1987	10/2008	08/1998	03/1980	09/1974	10/1978	11/2000	02/2001	09/2002	02/2009
Market	-26.32%	-20.51%	-17.67%	-14.19%	-12.53%	-12.53%	-11.38%	-10.89%	-10.69%	-10.67%
Carry Trade	-0.17%	-6.57%	-11.51%	0.00%	0.13%	3.26%	0.94%	0.58%	-7.27%	2.80%
	Panel B. 10 Worst Month for Carry Trade									
Date	09/1998	01/1998	08/1998	07/2002	12/1997	01/2002	07/1986	09/2002	01/1995	03/2002
Market	5.75%	0.02%	-17.67%	-8.62%	1.29%	-1.76%	-6.71%	-10.69%	1.61%	4.25%
Carry Trade	-20.66%	-20.20%	-11.51%	-10.25%	-9.83%	-9.12%	-7.29%	-7.27%	-7.18%	-6.70%

Table A.2. **Estimation of Linear Pricing Models: Developed Currencies, Equities, and Commodities**

Prices of risk, Fama&MacBeth standard errors in parentheses, χ^2 statistics testing for joint significance of pricing errors, root mean squared pricing errors (RMSPE) and the cross sectional R^2s for the unconditional CAPM and the downside risk CAPM (DR-CAPM). Test assets are five currency portfolios of developed countries, monthly re-sampled based on the interest rate differential with the US, five commodity futures portfolios, monthly re-sampled based on basis, and the six Fama & French portfolios, sorted on size and book-to-market. The market excess-return is included as a test asset. The sample period is January 1974 to December 2008 for a total of 420 observations. Starred estimates impose the restriction that the market excess-return is exactly priced and consequently no standard errors are reported.

	Currencies and Commodities		Currencies, Equities, and Commodities	
	CAPM	DR-CAPM	CAPM	DR-CAPM
λ	$0.32^\star$	$0.32^\star$	$0.32^\star$	$0.32^\star$
λ^-		1.45		1.39
		(0.55)		(0.39)
χ^2	32.67	13.08	96.05	47.10
p-val	0.06%	21.95%	0.00%	0.01%
RMSPE	0.30	0.10	0.31	0.15
R^2	-37.81%	83.65%	-13.71%	74.92%

Table A.3. **Estimation of Linear Pricing Models: Currencies. Winsorized**

Prices of risk, Fama&MacBeth standard errors in parentheses, χ^2 statistics testing for joint significance of pricing errors, root mean squared pricing errors (RMSPE) and the cross sectional R^2s for the unconditional CAPM and the downside risk CAPM (DR-CAPM). Test assets are six currency portfolios, monthly re-sampled based on the interest rate differential with the US. The market excess-return is included as a test asset. The sample period is January 1974 to March 2010 for a total of 435 observations. High inflation countries in the last portfolio are excluded. A country is considered to have high inflation if it has annualized monthly inflation 10% higher than US inflation. Starred estimates impose the restriction that the market excess-return is exactly priced and consequently no standard errors are reported. The first two columns winsorize the worst 5 market excess returns and the last two columns winsorize the currency portfolio returns for the worst 5 carry trade returns.

	Market Returns Winsorized		Currency Portfolio Returns Winsorized	
	CAPM	DR-CAPM	CAPM	DR-CAPM
λ	0.45*	0.45*	0.39*	0.39*
λ^-		0.96		2.49
		(0.43)		(0.81)
χ^2	41.13	31.01	50.00	35.27
p-val	0.00%	0.00%	0.00%	0.00%
RMSPE	0.19	0.11	0.21	0.11
R^2	21.66%	73.76%	4.75%	72.04%

Table A.4. **Estimation of Linear Pricing Models: Currencies and Commodities. Winsorized**

Prices of risk, Fama&MacBeth standard errors in parentheses, χ^2 statistics testing for joint significance of pricing errors, root mean squared pricing errors (RMSPE) and the cross sectional R^2s for the unconditional CAPM and the downside risk CAPM (DR-CAPM). Test assets are six currency portfolios, monthly re-sampled based on the interest rate differential with the US and five commodity futures portfolios, monthly re-sampled based on basis. The market excess-return is included as a test asset. The sample period is January 1974 to December 2008 for a total of 420 observations. High inflation countries in the last portfolio are excluded. A country is considered to have high inflation if it has annualized monthly inflation 10% higher than US inflation. Starred estimates impose the restriction that the market excess-return is exactly priced and consequently no standard errors are reported. The first two columns winsorize the worst 5 market excess returns and the last two columns winsorize the currency portfolio returns for the worst 5 carry trade returns.

	Market Returns Winsorized		Currency Portfolio Returns Winsorized	
	CAPM	DR-CAPM	CAPM	DR-CAPM
λ	0.39*	0.39*	0.32*	0.32*
λ^-		1.30		1.49
		(0.43)		(0.53)
χ^2	51.80	36.84	59.68	37.98
p-val	0.00%	0.01%	0.00%	0.01%
RMSPE	0.30	0.17	0.30	0.12
R^2	-40.27%	56.43%	-42.93%	76.67%

Table A.5. **Estimation of Linear Pricing Models: Currencies. All Countries**

Prices of risk, Fama&MacBeth standard errors in parentheses, χ^2 statistics testing for joint significance of pricing errors, root mean squared pricing errors (RMSPE) and the cross sectional R^2s for the unconditional CAPM and the downside risk CAPM (DR-CAPM). Test assets are six currency portfolios, monthly re-sampled based on the interest rate differential with the US. The market excess-return is included as a test asset. The sample period is January 1974 to March 2010 for a total of 435 observations. Starred estimates impose the restriction that the market excess-return is exactly priced and consequently no standard errors are reported.

	CAPM	DR-CAPM
λ	$0.39^\star$	$0.39^\star$
λ^-		5.32
		(1.37)
χ^2	49.96	27.25
p-val	0.00%	0.01%
RMSPE	0.25	0.12
R^2	-7.41%	75.11%

Table A.6. **Estimation of Linear Pricing Models: Currencies and Equities. All Countries**

Prices of risk, Fama&MacBeth standard errors in parentheses, χ^2 statistics testing for joint significance of pricing errors, root mean squared pricing errors (RMSPE) and the cross sectional R^2s for the unconditional CAPM and the downside risk CAPM (DR-CAPM). Test assets are six currency portfolios, monthly re-sampled based on the interest rate differential with the US, and the six Fama & French portfolios sorted on size and book-to-market. The market excess-return is included as a test asset. The sample period is January 1974 to March 2010, for a total of 435 observations. Starred estimates impose the restriction that the market excess-return is exactly priced and consequently no standard errors are reported.

	CAPM	DR-CAPM
λ	$0.39^\star$	$0.39^\star$
λ^-		1.46
		(0.43)
χ^2	123.58	72.01
p-val	0.00%	0.00%
RMSPE	0.29	0.20
R^2	13.46%	57.00%

Table A.7. **Estimation of Linear Pricing Models: Currencies, Equities, and Commodities. All Countries**

Prices of risk, Fama&MacBeth standard errors in parentheses, χ^2 statistics testing for joint significance of pricing errors, root mean squared pricing errors (RMSPE) and the cross sectional R^2s for the unconditional CAPM and the downside risk CAPM (DR-CAPM). Test assets are six currency portfolios, monthly re-sampled based on the interest rate differential with the US, five commodity futures portfolios, monthly re-sampled based on the commodity basis, and the six Fama & French portfolios sorted on size and book-to-market. The market excess-return is included as a test asset. The rightmost two columns include the six Fama & French portfolios. The sample period is January 1974 to December 2008 for a total of 420 observations. Starred estimates impose the restriction that the market excess-return is exactly priced and consequently no standard errors are reported.

	Currencies and Commodities		Currencies, Equities, and Commodities	
	CAPM	DR-CAPM	CAPM	DR-CAPM
λ	$0.32^\star$	$0.32^\star$	$0.32^\star$	$0.32^\star$
λ^-		1.53		1.44
		(0.56)		(0.40)
χ^2	59.80	35.79	136.42	72.86
p-val	0.00%	0.02%	0.00%	0.00%
RMSPE	0.32	0.16	0.33	0.18
R^2	-46.89%	63.30%	-24.09%	63.50%

Table A.8. **Estimation of Linear Pricing Models: Currencies, Equities, and Sovereigns. All Countries**

Prices of risk, Fama&MacBeth standard errors in parentheses, χ^2 statistics testing for joint significance of pricing errors, root mean squared pricing errors (RMSPE) and the cross sectional R^2s for the unconditional CAPM and the downside risk CAPM (DR-CAPM). Test assets are six currency portfolios, monthly re-sampled based on the interest rate differential with the US, six sovereign bond portfolios, monthly re-sampled based on their probability of default and bond beta, and the six Fama & French portfolios, sorted on size and book-to-market. The rightmost include columns use the six Fama & French portfolios. The market excess-return is included as a test asset. The sample period is January 1995 to March 2010 for a total of 183 observations. Starred estimates impose the restriction that the market excess-return is exactly priced and consequently no standard errors are reported.

	Currencies and Sovereigns		Currencies, Equities, and Sovereigns	
	CAPM	DR-CAPM	CAPM	DR-CAPM
λ	0.41*	0.41*	0.41*	0.41*
λ^-		0.58		0.61
		(0.21)		(0.21)
χ^2	59.74	58.76	112.58	110.23
p-val	0.00%	0.00%	0.00%	0.00%
RMSPE	0.47	0.29	0.43	0.28
R^2	-36.88%	46.73%	-37.97%	41.97%

Table A.9. **Estimation of Linear Pricing Models: Currencies. Subsample**

Prices of risk, Fama&MacBeth standard errors in parentheses, χ^2 statistics testing for joint significance of pricing errors, root mean squared pricing errors (RMSPE) and the cross sectional R^2s for the unconditional CAPM and the downside risk CAPM (DR-CAPM). Test assets are six currency portfolios, monthly re-sampled based on the interest rate differential with the US. High inflation countries in the last portfolio are excluded. A country is considered to have high inflation if it has annualized monthly inflation 5% higher than US inflation. The market excess-return is included as a test asset. The sample period is June 1980 to March 2010 for a total of 358 observations. Starred estimates impose the restriction that the market excess-return is exactly priced and consequently no standard errors are reported.

	CAPM	DR-CAPM
λ	$0.45^\star$	$0.45^\star$
λ^-		2.15
		(0.97)
χ^2	33.75	10.85
p-val	0.00%	9.32%
RMSPE	0.18	0.09
R^2	32.75%	84.23%

Table A.10. **Estimation of Linear Pricing Models: Currencies, Including Basket 6B. Subsample**

Prices of risk, Fama&MacBeth standard errors in parentheses, χ^2 statistics testing for joint significance of pricing errors, root mean squared pricing errors (RMSPE) and the cross sectional R^2s for the unconditional CAPM and the downside risk CAPM (DR-CAPM). Test assets are seven currency portfolios (1-5, 6A, 6B). Currencies are first sorted into 6 baskets monthly based on their interest rate differential with the US. Then high inflation countries in the sixth portfolio are subdivided into basket 6B. A country is considered to have high inflation if it has annualized monthly inflation 10% higher than US inflation. The market excess-return is included as a test asset. The sample period is June 1980 to March 2010 for a total of 358 observations. Starred estimates impose the restriction that the market excess-return is exactly priced and consequently no standard errors are reported.

	CAPM	DR-CAPM
λ	$0.45^\star$	$0.45^\star$
λ^-		3.34
		(1.00)
χ^2	42.85	15.80
p-val	0.00%	2.70%
RMSPE	0.31	0.19
R^2	-9.92%	59.80%

Table A.11. **Estimation of Linear Pricing Models: Currencies. Estimated on Baskets 1-6A, Basket 6B Included Only in the Fit. Subsample**

Prices of risk, Fama&MacBeth standard errors in parentheses, χ^2 statistics testing for joint significance of pricing errors, root mean squared pricing errors (RMSPE) and the cross sectional R^2s for the unconditional CAPM and the downside risk CAPM (DR-CAPM). Test assets are seven currency portfolios (1-5, 6A, 6B). Currencies are first sorted into 6 baskets monthly based on their interest rate differential with the US. Then high inflation countries in the sixth portfolio are subdivided into basket 6B. A country is considered to have high inflation if it has annualized monthly inflation 10% higher than US inflation. The market excess-return is included as a test asset.. The sample period is Jun 1980 to March 2010 for a total of 358 observations. The models are estimated using the currency baskets 1-6A, basket 6B is included only to assess the model fit. Starred estimates impose the restriction that the market excess-return is exactly priced and consequently no standard errors are reported.

	CAPM	DR-CAPM
λ	$0.45^\star$	$0.45^\star$
λ^-		1.95
		(0.72)
χ^2	42.85	14.35
p-val	0.00%	4.53%
RMSPE	0.31	0.21
R^2	-9.92%	49.72%

Table A.12. **Estimation of Linear Pricing Models: Currencies, Equities, and Commodities. Unrestricted Estimation**

Prices of risk, Fama&MacBeth standard errors in parentheses, χ^2 statistics testing for joint significance of pricing errors, root mean squared pricing errors (RMSPE) and the cross sectional R^2s for the unconditional CAPM and the downside risk CAPM (DR-CAPM). Test assets are six currency portfolios, monthly re-sampled based on the interest rate differential with the US, five commodity futures portfolios, monthly re-sampled based on basis, and the six Fama & French portfolios, sorted on size and book-to-market. The market excess-return is included as a test asset. The sample period is January 1974 to December 2008 for a total of 420 observations. High inflation countries in the last portfolio are excluded. A country is considered to have high inflation if it has annualized monthly inflation 10% higher than US inflation. Starred estimates impose the restriction that the market excess-return is exactly priced and consequently no standard errors are reported.

	CAPM	DR-CAPM
λ	0.47	0.29
	(0.24)	(0.24)
λ^-		1.45
		(0.41)
χ^2	128.27	64.48
p-val	0.00%	0.00%
RMSPE	0.30	0.15
R^2	-6.53%	74.07%

Table A.13. **Estimation of Linear Pricing Models: Currencies, Equities, and Commodities. Composite Market Return Index**

Prices of risk, Fama&MacBeth standard errors in parentheses, χ^2 statistics testing for joint significance of pricing errors, root mean squared pricing errors (RMSPE) and the cross sectional R^2s for the unconditional CAPM and the downside risk CAPM (DR-CAPM). Test assets are six currency portfolios, monthly re-sampled based on the interest rate differential with the US, five commodity futures portfolios, monthly re-sampled based on basis, and the six Fama & French portfolios, sorted on size and book-to-market. The market excess-return is included as a test asset. The market excess-return is the equally weighted mean of the CRSP value weighted excess return, the mean of the 6 currency portfolio excess returns and the mean of the 5 commodity portfolios. The sample period is January 1974 to December 2008 for a total of 420 observations. High inflation countries in the last portfolio are excluded. A country is considered to have high inflation if it has annualized monthly inflation 10% higher than US inflation. Starred estimates impose the restriction that the market excess-return is exactly priced and consequently no standard errors are reported.

	CAPM	DR-CAPM
λ	$0.25^\star$	$0.25^\star$
λ^-		1.02
		(0.20)
χ^2	125.54	77.02
p-val	0.00%	0.00%
RMSPE	0.26	0.14
R^2	20.91%	76.43%

Table A.14. **Estimation of Linear Pricing Models: Currencies, Equities, and Commodities. MSCI World Equity Market Index**

Prices of risk, Fama&MacBeth standard errors in parentheses, χ^2 statistics testing for joint significance of pricing errors, root mean squared pricing errors (RMSPE) and the cross sectional R^2s for the unconditional CAPM and the downside risk CAPM (DR-CAPM). Test assets are six (five) currency portfolios (of developed countries), monthly re-sampled based on the interest rate differential with the US, five commodity futures portfolios, monthly re-sampled based on basis, and the six Fama & French portfolios, sorted on size and book-to-market. The market excess-return is included as a test asset. The sample period is January 1974 to December 2008 for a total of 420 observations. The last column estimates the model only on the five currency portfolios of developed countries and the six Fama & French portfolios besides the small growth portfolio. High inflation countries in the last portfolio are excluded. A country is considered to have high inflation if it has annualized monthly inflation 10% higher than US inflation. Starred estimates impose the restriction that the market excess-return is exactly priced and consequently no standard errors are reported.

	Currencies, Equities, and Commodities		Dev. Currencies, Equities, and Commodities		Currencies and FF2-6
	CAPM	DR-CAPM	CAPM	DR-CAPM	DR-CAPM
λ	$0.28^\star$	$0.28^\star$	$0.28^\star$	$0.28^\star$	$0.28^\star$
λ^-		0.81		0.80	0.92
		(0.28)		(0.28)	(0.31)
χ^2	129.27	73.34	96.34	46.12	8.65
p-val	0.00%	0.00%	0.00%	0.01%	56.60%
RMSPE	0.32	0.20	0.32	0.20	0.10
R^2	-25.33%	52.62%	-22.59%	54.98%	88.72%

Table A.15. **Estimation of Linear Pricing Models: Equities. Long Sample**

Prices of risk, Fama&MacBeth standard errors in parentheses, χ^2 statistics testing for joint significance of pricing errors, root mean squared pricing errors (RMSPE) and the cross sectional R^2s for the downside risk CAPM (DR-CAPM). Test assets are the six Fama & French portfolios sorted on size and book-to-market. The market excess-return is included as a test asset. The sample period is July 1931 to March 2010 in the left panel and to December 1999 in the right panel for a total of 945 and 822 observations, respectively.

	DR-CAPM	DR-CAPM (1999)
λ	$0.49^\star$	$0.59^\star$
λ^-	2.00	1.70
	(0.66)	(0.77)
χ^2	13.61	6.67
p-val	3.43%	35.26%
RMSPE	0.11	0.08
R^2	63.98%	75.17%

Table A.16. **Estimation of Linear Pricing Models: Currencies. Alternative Specification**

Prices of risk, Fama&MacBeth standard errors in parentheses, χ^2 statistics testing for joint significance of pricing errors, root mean squared pricing errors (RMSPE) and the cross sectional R^2s for the unconditional CAPM and the downside risk CAPM (DR-CAPM). In the two left columns, test assets are six currency portfolios, monthly re-sampled based on the interest rate differential with the US. High inflation countries in the last portfolio are excluded. A country is considered to have high inflation if it has annualized monthly inflation 10% higher than US inflation. In the two right columns, test assets are five currency portfolios of developed countries. The market excess-return is included as a test asset. The sample period is January 1974 to March 2010 for a total of 435 observations. Starred estimates impose the restriction that the market excess-return is exactly priced and consequently no standard errors are reported.

	All Currencies		Developed Currencies	
	CAPM	DR-CAPM	CAPM	DR-CAPM
λ	$0.39^\star$	$0.39^\star$	$0.39^\star$	$0.39^\star$
λ^-		1.88		2.20
		(0.59)		(0.79)
χ^2	42.28	21.19	22.36	7.78
p-val	0.00%	0.17%	0.04%	9.98%
RMSPE	0.19	0.09	0.17	0.07
R^2	8.77%	78.88%	-1.94%	84.08%

Table A.17. **Estimation of Linear Pricing Models: Currencies and Equities. Alternative Specification**

Prices of risk, Fama&MacBeth standard errors in parentheses, χ^2 statistics testing for joint significance of pricing errors, root mean squared pricing errors (RMSPE) and the cross sectional R^2s for the unconditional CAPM and the downside risk CAPM (DR-CAPM). Test assets are six currency portfolios, monthly re-sampled based on the interest rate differential with the US, and the six Fama & French portfolios sorted on size and book-to-market. The sample period is January 1974 to March 2010, for a total of 435 observations. The market excess-return is included as a test asset. A country is considered to have high inflation if it has annualized monthly inflation 10% higher than US inflation. Starred estimates impose the restriction that the market excess-return is exactly priced and consequently no standard errors are reported.

	Fama & French PF	
	CAPM	DR-CAPM
λ	$0.39^{\star}$	$0.39^{\star}$
λ^{-}		1.20
		(0.33)
χ^2	114.54	63.32
p-val	0.00%	0.00%
RMSPE	0.26	0.17
R^2	24.31%	69.45%

Table A.18. **Estimation of Linear Pricing Models: Currencies, Equities, and Commodities. Alternative Specification**

Prices of risk, Fama&MacBeth standard errors in parentheses, χ^2 statistics testing for joint significance of pricing errors, root mean squared pricing errors (RMSPE) and the cross sectional R^2s for the unconditional CAPM and the downside risk CAPM (DR-CAPM). Test assets are six currency portfolios, monthly re-sampled based on the interest rate differential with the US, five commodity futures portfolios, monthly re-sampled based on the commodity basis, and the six Fama & French portfolios, sorted on size and book-to-market. The market excess-return is included as a test asset. The two rightmost columns use the six Fama & French portfolios. The sample period is January 1974 to December 2008 for a total of 420 observations. High inflation countries in the last portfolio are excluded. A country is considered to have high inflation if it has annualized monthly inflation 10% higher than US inflation.

	Currencies and Commodities		Currencies, Equities, and Commodities	
	CAPM	DR-CAPM	CAPM	DR-CAPM
λ	0.32*	0.32*	0.32*	0.32*
λ^-		1.31		1.22
		(0.47)		(0.33)
χ^2	52.66	24.41	128.27	64.47
p-val	0.00%	1.11%	0.00%	0.00%
RMSPE	0.30	0.11	0.31	0.15
R^2	-42.93%	82.13%	-17.38%	71.92%

Table A.19. **Estimation of Linear Pricing Models: Currencies, Equities, and Sovereigns. Alternative Specification**

Prices of risk, Fama&MacBeth standard errors in parentheses, χ^2 statistics testing for joint significance of pricing errors, root mean squared pricing errors (RMSPE) and the cross sectional R^2s for the unconditional CAPM and the downside risk CAPM (DR-CAPM). Test assets are six currency portfolios, monthly re-sampled based on the interest rate differential with the US, six sovereign bond portfolios, monthly re-sampled based on the probability of default and bond beta, and the six Fama & French portfolios, sorted on size and book-to-market. The market excess-return is included as a test asset. The sample period is January 1995 to March 2010 for a total of 183 observations. High inflation countries in the last portfolio are excluded. A country is considered to have high inflation if it has annualized monthly inflation 10% higher than US inflation.

	Currencies and Sovereigns		Currencies, Equities, and Sovereigns	
	CAPM	DR-CAPM	CAPM	DR-CAPM
λ	0.41*	0.41*	0.41*	0.41*
λ^-		0.51		0.54
		(0.20)		(0.19)
χ^2	40.26	37.64	88.31	84.52
p-val	0.01%	0.02%	0.00%	0.00%
RMSPE	0.41	0.22	0.38	0.23
R^2	-20.81%	65.01%	-22.66%	56.19%

Table A.20. **Model Robustness: Currencies. Three States**

Prices of risk, Fama&MacBeth standard errors in parentheses, χ^2 statistics testing for joint significance of pricing errors, root mean squared pricing errors (RMSPE) and the cross sectional R^2s for a three state downside risk CAPM (DR-CAPM). Test assets are six currency portfolios, monthly resampled based on the interest rate differential with the US, and the six Fama & French portfolios, sorted on size and book-to-market. The market excess-return is included as a test asset. The sample period is January 1974 to March 2010 for a total of 435 observations. High inflation countries in the last portfolio are excluded. A country is considered to have high inflation if it has annualized monthly inflation 10% higher than US inflation. Downstates (upstates) are all months in which the market return is more than 0.5 standard deviation below (above) its sample mean with intermediate states defined as all remaining observations.

	Currencies	Currencies and Equities
λ_+	-1.22	-0.69
	(0.44)	(0.32)
λ_0	-0.52	-0.78
	(0.41)	(0.32)
λ_-	2.14	1.95
	(0.65)	(0.49)
χ^2	11.56	63.95
p-val	2.09%	0.00%
RMSPE	0.07	0.15
R^2	86.26%	74.34%

Table A.21. **PCA: Currencies, Equities, and Commodities**

Loadings (PC1 – PC16) and percentage of the total variance explained by each principal component of a principal components analysis on the covariance matrix of six currencies portfolios (Cur-PF1 – Cur-PF6A), monthly re-sampled based on the interest rate differential with the US, five commodity futures portfolios (Com-PF1 – Com-PF6), monthly re-sampled based on basis and six stock portfolios (FF-PF1 – FF-PF6), sorted on size and book to market. High inflation countries in the last currency portfolio are excluded. A country is considered to have high inflation if it has annualized monthly inflation 10% higher than US inflation. The sample period is January 1974 to December 2008, a total of 420 observations.

	PC1	PC2	PC3	PC4	PC5	PC6	PC6	PC7	PC8	PC9	PC10	PC11	PC12	PC13	PC14	PC15	PC16
Cur-PF1	-0.01	0.05	0.39	-0.03	0.07	-0.03	0.01	-0.01	0.06	0.25	0.54	0.08	0.16	-0.41	-0.26	-0.46	-0.03
Cur-PF2	-0.02	0.05	0.39	-0.02	0.06	-0.03	0.00	0.01	0.06	0.19	0.38	0.07	-0.23	-0.05	0.47	0.61	0.00
Cur-PF3	-0.01	0.06	0.40	-0.03	0.06	-0.01	0.04	0.03	0.09	0.17	-0.09	-0.18	0.00	0.67	0.32	-0.45	-0.06
Cur-PF4	-0.02	0.05	0.36	-0.02	0.07	0.01	0.02	0.02	0.07	0.14	-0.11	-0.11	0.10	0.31	-0.73	0.41	0.04
Cur-PF5	-0.03	0.05	0.40	-0.03	0.05	0.05	0.00	0.00	0.08	0.19	-0.73	0.13	-0.10	-0.46	0.11	-0.05	0.05
Cur-PF6A	-0.04	0.06	0.42	-0.02	0.06	0.03	0.16	-0.24	-0.33	-0.78	0.02	0.05	0.07	-0.02	0.02	-0.02	0.00
Com-PF1	-0.06	0.49	-0.11	-0.71	0.18	0.33	-0.31	-0.05	0.06	-0.05	0.02	0.02	0.00	0.01	0.00	0.00	0.01
Com-PF2	-0.08	0.41	-0.08	-0.11	-0.32	-0.35	0.52	-0.13	0.53	-0.11	-0.01	0.01	0.03	-0.02	0.00	0.02	0.00
Com-PF3	-0.08	0.47	-0.01	0.05	-0.32	0.00	0.22	0.36	-0.66	0.22	-0.01	-0.05	0.04	-0.01	0.01	0.01	0.00
Com-PF4	-0.08	0.38	0.05	0.33	-0.08	-0.48	-0.69	-0.09	0.03	-0.11	-0.02	0.01	-0.03	0.01	-0.02	-0.02	0.01
Com-PF5	-0.08	0.42	-0.12	0.57	0.49	0.42	0.17	-0.03	0.16	-0.01	0.02	0.01	0.02	-0.01	0.02	0.00	0.00
FF-PF1	-0.54	-0.09	-0.06	-0.12	0.39	-0.31	0.12	0.35	-0.03	-0.09	0.00	0.20	-0.43	0.04	-0.13	-0.09	-0.20
FF-PF2	-0.42	-0.07	-0.06	-0.05	0.14	-0.12	0.06	-0.22	-0.11	0.11	0.02	-0.25	0.09	-0.02	0.07	-0.02	0.79
FF-PF3	-0.41	-0.06	-0.08	-0.03	0.08	-0.09	0.03	-0.45	-0.16	0.23	-0.07	-0.09	0.46	-0.03	0.10	0.13	-0.52
FF-PF4	-0.35	-0.11	0.10	0.04	-0.18	0.18	-0.15	0.56	0.27	-0.21	0.00	0.09	0.55	-0.01	0.14	0.08	0.06
FF-PF5	-0.32	-0.05	0.07	0.08	-0.34	0.31	-0.09	-0.03	0.12	-0.10	0.05	-0.64	-0.39	-0.17	-0.07	-0.05	-0.19
FF-PF6	-0.32	-0.04	0.02	0.11	-0.41	0.33	-0.07	-0.30	0.00	0.11	0.04	0.63	-0.21	0.20	-0.09	-0.07	0.09
Explained	47.02%	21.16%	7.06%	5.45%	4.12%	3.44%	2.94%	2.50%	2.11%	1.81%	0.52%	0.48%	0.43%	0.35%	0.27%	0.23%	0.12%

Table A.22. **Estimation of Linear Pricing Models: Currencies and Equities. Other Risk-based Models**

Prices of risk, Fama&MacBeth standard errors in parentheses, χ^2 statistics testing for joint significance of pricing errors, root mean squared pricing errors (RMSPE) and the cross sectional R^2s for the extended Durable Consumption CAPM (DC-CAPM) and the model of Lustig, Roussanov and Verdelhan (LRV). In the two left columns, test assets are six currency portfolios, monthly re-sampled based on the interest rate differential with the US. High inflation countries in the last portfolio are excluded. A country is considered to have high inflation if it has annualized monthly inflation 10% higher than US inflation. The next two columns use five currency portfolios of developed countries as test assets and the rightmost two columns add the six Fama & French equity portfolios sorted on size and book-to-market. The market excess-return is included as a test asset. The sample period is January 1974 to March 2010 for a total of 435 observations.

	All Currencies		**Developed Currencies**		**Currencies and Equities**	
	EZ-DCAPM	LRV	EZ-DCAPM	LRV	EZ-DCAPM	LRV
λ_{market}	0.42		0.41		0.46	
	(0.23)		(0.23)		(0.23)	
λ_{nondur}	-0.06		-0.12		-0.18	
	(0.19)		(0.24)		(0.13)	
λ_{dur}	3.11		4.39		2.21	
	(1.39)		(1.91)		(0.77)	
λ_{RX}		0.14		0.09		0.20
		(0.10)		(0.11)		(0.11)
λ_{HML}		0.54		0.57		
		(0.16)		(0.17)		(0.38)
χ^2	36.55	25.14	14.27	3.51	95.71	97.40
p-val	0.00%	0.01%	0.26%	47.56%	0.00%	0.00%
RMSPE	0.15	0.14	0.10	0.06	0.21	0.30
R^2	42.57%	51.29%	70.26%	89.24%	53.25%	1.07%

Table A.23. **Estimation of Linear Pricing Models: Currencies, Equities, Commodities, and Sovereign Bonds. Other Risk-Based Models**

Prices of risk, Fama&MacBeth standard errors in parentheses, χ^2 statistics testing for joint significance of pricing errors, root mean squared pricing errors (RMSPE) and the cross sectional R^2s for the extended Durable Consumption CAPM (DC-CAPM) and the model of Lustig, Roussanov and Verdelhan (LRV). Test assets are six currency portfolios, monthly re-sampled based on the interest rate differential with the US. The leftmost four columns also include five commodity futures portfolios, monthly re-sampled based on basis, as test assets. The rightmost four columns also include six sovereign bond portfolios, monthly re-sampled based on their probability of default and bond beta, as test assets. The six Fama & French portfolios sorted on size and book-to-market are included when indicated. The market excess-return is always included as a test asset. The sample period is January 1974 to March 2008 for a total of 420 observations in the leftmost four columns, January 1995 to March 2010 for a total of 183 observations in the rightmost four columns.

	Currencies and Commodities				**Currencies and Sovereigns**			
			incl Equities				incl Equities	
	EZ-DCAPM	LRV	EZ-DCAPM	LRV	EZ-DCAPM	LRV	EZ-DCAPM	LRV
λ_{market}	0.37		0.37		0.66		0.42	
	(0.23)		(0.23)		(0.39)		(0.37)	
λ_{nondur}	0.20		0.17		-0.24		-0.33	
	(0.14)		(0.13)		(0.10)		(0.12)	
λ_{dur}	2.59		1.27		2.79		1.88	
	(1.37)		(0.66)		(0.83)		(0.74)	
λ_{RX}		0.17		0.19		0.35		0.33
		(0.11)		(0.11)		(0.15)		(0.19)
λ_{HML}		0.55		1.00		0.70		0.65
		(0.17)		(0.39)		(0.34)		(0.35)
χ^2	47.61	37.63	117.58	113.23	35.35	37.36	83.63	85.41
p-val	0.00%	0.00%	0.00%	0.00%	0.01%	0.01%	0.00%	0.00%
RMSPE	0.23	0.26	0.26	0.31	0.18	0.32	0.26	0.31
R^2	13.87%	-11.60%	17.40%	-15.19%	76.35%	25.19%	40.48%	18.87%

Table A.24. **Estimation of Linear Pricing Models: Currencies, Equities, and Commodities**

Prices of risk, Fama&MacBeth standard errors in parentheses, χ^2 statistics testing for joint significance of pricing errors, root mean squared pricing errors (RMSPE) and the cross sectional R^2s for the downside risk CAPM (DR-CAPM) and the Co-Skewness CAPM (Co-Skew). Test assets are six currency portfolios, monthly re-sampled based on the interest rate differential with the US, five commodity futures portfolios, monthly re-sampled based on basis, and the six Fama & French portfolios, sorted on size and book-to-market. The market excess-return is included as a test asset. The sample period is January 1974 to December 2008 for a total of 420 observations. High inflation countries in the last portfolio are excluded. A country is considered to have high inflation if it has annualized monthly inflation 10% higher than US inflation. Starred estimates impose the restriction that the market excess-return is exactly priced and consequently no standard errors are reported.

	DR-CAPM	Co–Skew
λ	$0.32^{\star}$	0.47
		(0.24)
λ^{-}	1.40	
	(0.38)	
$\lambda_{co-skew}$		-0.62
		(0.20)
χ^2	64.48	126.01
p-val	0.00%	0.00%
RMSPE	0.15	0.23
R^2	73.52%	34.16%