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The Effect of Relative Wealth Concerns on the Cross-section of Stock Returns*

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Abstract

We test the cross section implications of an asset pricing model where agents have relative wealth concerns with respect to a reference group which we call their peers. The literature suggests two reasons (not mutually exclusive) why investors might want to hedge local risk resulting from relative wealth concerns: keeping up with the Joneses preferences and competition for local assets in short supply. In the presence of some market friction, a negative risk premium obtains for the local risk factor -non-diversifiable wealth of the peers- in equilibrium. We study the empirical implications of this model using as peer groups the nine US Census divisions. As a proxy for the local risk factor we use divisional labor income. We find substantial support for the predictions of the model; moreover the effects are stronger in divisions with lower population density. A possible explanation is that the effect of relative wealth concerns is stronger in low density regions because it is easier to identify the wealth of the reference group. Additionally, lower density may imply higher competition for assets in short supply (like human capital) and, therefore, a stronger desire to hedge the corresponding inflationary risk.

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Abstract

We test the cross section implications of an asset pricing model where agents have relative wealth concerns with respect to a reference group which we call their peers. The literature suggests two reasons (not mutually exclusive) why investors might want to hedge local risk resulting from relative wealth concerns: keeping up with the Joneses preferences and competition for local assets in short supply. In the presence of some market friction, a negative risk premium obtains for the local risk factor -non-diversifiable wealth of the peers- in equilibrium. We study the empirical implications of this model using as peer groups the nine US Census divisions. As a proxy for the local risk factor we use divisional labor income. We find substantial support for the predictions of the model; moreover the effects are stronger in divisions with lower population density. A possible explanation is that the effect of relative wealth concerns is stronger in low density regions because it is easier to identify the wealth of the reference group. Additionally, lower density may imply higher competition for assets in short supply (like human capital) and, therefore, a stronger desire to hedge the corresponding inflationary risk.

1 Introduction

The literature suggests two not necessarily exclusive cases in which investor's relative wealth concerns with respect to some reference group, that we will call their "peers", may have an effect in the equilibrium pricing of financial securities. First, agents may display "external habit formation" (EHF) in their preferences. In this case, the utility of the investors depends on the wealth of their peers ("the Joneses") and investors bias their portfolio holdings towards securities which are correlated with the wealth of their peers so as to"keep up with the Joneses". Second, relative wealth concerns may also arise endogenously, without assuming EHF preferences. DeMarzo, Kaniel and Kremer (2004) show that individuals with standard preferences might care about the wealth of their peers because competition for non-diversifiable assets in limited supply drives their price up; if investors cannot compete in wealth with their peers they might be left out of the market. Hedging this local inflationary risk may, under certain conditions, bias investors' portfolios towards assets positively correlated with the local, non-diversifiable asset. In equilibrium, whatever the cause f the bias in portfolio holdings, investors pay a premium for these assets.

Gómez, Priestley and Zapatero (2008) examine the asset pricing implications of relative wealth concerns and show that in the presence of local non-diversifiable assets (like, for instance, human capital or real estate) relative wealth concerns result in an approximate multi-beta asset pricing model. This result is attained when relative wealth concerns are driven by arguments based on either EHF or non-diversifiable assets which are in short-supply. They call this model the KEEPM, which stands for "KEEping up Pricing Model." According to the KEEPM, stock returns are explained by their covariances with the market portfolio and the local risk factors (one per peer group). These factors capture the risk of deviating from the non-diversifiable local wealth. The model predicts that the price of risk on each of the local factors should be negative because investors are willing to pay more (expect lower return) for those stocks that help them to hedge the risk of deviating from their peer's non-diversifiable wealth.[1]

Gómez, Priestley and Zapatero (2008) find strong support for the KEEPM at the international level. That is, investors consider their country peers as a reference group and are willing to pay extra for securities that are positively correlated with the idiosyncratic, and therefore the non-diversifiable, component of local (national) income. This factor acts as a proxy for the non-diversifiable wealth of the reference group and, in equilibrium, it is shown to command a negative risk premium.

The objective of this paper is to examine empirically if relative wealth concerns are present in the US stock market at some disaggregate level. That is, if there are segmented regions populated by investors who use other individuals of the same region as their reference group, with the exclusion of the individuals of other regions. Alternatively, whether investors of different regions exhibit different levels of relative wealth concerns, regardless of their reference group. In particular, we consider the nine US Census divisions and test whether stock returns across the nine divisions are priced by local (divisional) risk factors that proxy for relative wealth concerns.

For our analysis, stocks are sorted into the nine divisions depending on the location of their headquarters. As a proxy for the wealth of the peers we use divisional labor income. More precisely, since our model predicts that the relevant variable is the idiosyncratic wealth, we use the residual of labor income

[1] Galí (1994) shows that in the absence of a market friction, such as the existence of non-diversifiable assets, optimal portfolio holdings are identical across investors and only the market risk is priced in equilibrium.

with respect to the domestic market portfolio. In each division, we form a factor mimicking portfolio that is the difference between the equally weighted return on a portfolio that includes the one third of the stocks with the highest correlation with the orthogonal labor income and the equally weighted return on a portfolio with the lowest correlation with the orthogonal labour income.

We assess the ability of this factor to explain the cross section of divisional returns sorted by the coefficient on the orthogonal labor income and sorted by market capitalization. We perform the analysis in two ways. First, we perform a time series analysis of returns following Black, Jensen and Scholes (1972) and Fama and French (1993) and test whether the intercepts are jointly zero using the GRS test statistic. In all but one marginal case, we accept the null hypothesis that the intercepts are jointly zero. The estimated coefficients on the orthogonal labor income factor are generally statistically significant, even in the presence of the Fama and French (1993) factors.

We provide additional insights into the cross-sectional pattern of returns by estimating the risk premia directly using the cross-sectional methodology of Fama and MacBeth (1973). In all our tests, the risk premia corresponding to the local (divisional) risk factors are negative, as predicted by the model. We consider the possibility that the local risk factors are not local but instead global. That is, we form a global (national) orthogonal labor income factor. This factor is priced in the cross-section, however, further analysis suggests that it is the local component of this global factor that investors are concerned with.

Inspired by the insights of Hong, Kubik and Stein (2008), we rank the nine census divisions according to their population density. We find that in divisions with low population density our results are very compelling from an economic point of view and strongly statistically significant. According to our model, the economic size of the risk premium depends on the value of the "keeping up with the Joneses," in the case of EHF. Therefore, a possible explanation of our findings is that in divisions with lower population density it is easier for investors to assess the level of wealth of their peers because, for example, in smaller, rural communities people tend to know each other better and have more information about each other than in densely populated urban communities.

Our paper is complementary to Gómez, Priestley and Zapatero (2008) who find evidence in favor of the KEEPM at the international level on portfolios of US, UK, German and Japanese stocks. For all countries, prices of domestic stocks that help hedging the country-specific labor risk have a negative risk premium which agents willingly accept. However, focusing on domestic, divisional, rather than international portfolio choices, poses certain advantages and new challenges. First, unlike in an international setting, the purely domestic problem is free of a number of "usual suspects" for portfolio biases. Arguably, barriers, either explicit (like regulation, taxes, financial or human capital controls), or tacit (like language or culture), cannot be invoked to explain domestic portfolio biases. Second, additional risk sources, like exchange risk or country-specific political risk, disappear. Third, as noted above, issues such as population density, and differences in the number of firms and book value across divisions are potential factors that could drive relative wealth concerns at the domestic level. Alternatively (but the explanations are not mutually exclusive), lower density may imply higher competition for assets in short supply (like human capital) and, therefore, induce a stronger relative wealth concern.

The paper is organized as follows. The related literature is discussed in the following subsection. We present the theory and derive the KEEPM in section 2. Section 3 describes the data and discusses the empirical results and robustness tests. Section 4 offers some final remarks and closes the paper.

1.1 Related literature

Keeping up with the Joneses preferences were introduced by Abel (1990) and further studied by Galí (1994). Previous papers have studied the theoretical asset pricing implications of relative wealth concerns: Gómez (2007) for the case of EHF and DeMarzo, Kaniel and Kremer (2004, 2006) for the case of price-driven relative wealth concerns. Evidence of the existence of this type of preferences is presented in Ravina (2005).

In a recent paper, Korniotis (2008) presents and tests a EHF model where investors at the state level in the US care about broader regional consumption risk (defined at different aggregation levels). As a result, they are willing to pay for keeping up with regional consumption; hence a negative, statistically significant regional risk-premium arises. Our model is different, and complements Korniotis' findings, both theoretically and empirically. Theory wise, our investors are concerned about hedging local non-diversifiable risk. Unlike the regional consumption risk factors in Korniotis' model, our risk factors are defined relative to specific non-diversifiable sources of income, like labor income or house prices. Moreover, these factors may arise endogenously, as shown by DeMarzo, Kaniel and Kremer (2004), without assuming EHF. Empirically, Korniotis's (2008) EHF risk factor is averaged across regions. Our local risk factors are division-specific. We study the sign, magnitude and significance of the negative risk premia across the nine US Census divisions and for two sources of non-diversifiable risk, income labor and house prices. This allows us to understand better the impact of the local risk factors as well and their origin, whether endogenous (hedging local price inflation) or exogenous (EHF).

Our paper is closely related to the literature on portfolio under-diversification. The theory predicts that, in a frictionless model with full market participation and complete financial markets, investors should hold the same well-diversified portfolio. This prediction was first refuted at the international level by the seminal paper of French and Poterba (1991). This is known as the "home bias puzzle" and refers to the finding that investors over-invest in domestic stocks relative to the optimal global risk-diversification level.[2]

More recently, several papers have documented that this lack of diversification is also present at the domestic level within the US. This phenomenon has been dubbed the "home bias at home puzzle." Coval and Moskowitz (1999), for instance, study the investment behavior of money managers and observe that they favor (with respect to what would be optimal) local firms. Huberman (2001) uses the fact that individuals prefer to invest in their local Bell company to the other divisional Bell companies to argue that "familiarity" drives this bias. Shore and White (2002) propose external habit formation as an explanation for the puzzle. Ivković and Weisbenner (2005) and Massa and Simonov (2006) show that US and Swedish households, respectively, exhibit a strong preference for local investments. Their empirical tests seem to suggest that investors exploit local information to obtain higher returns. Finally, two recent papers have documented community effects in market participation. Hong, Kubik and Stein (2004) show that sociable investors (defined as those who interact with their neighbors or attend church) are more

[2]For a literature review of this puzzle and suggested explanations see Lewis (1999).

likely to invest in stocks, controlling for other factors. They interpret this finding as evidence of market participation as a public good: wider participation decreases fixed entrance costs for sociable investors. Brown, Ivković, Smith and Weisbenner (2008) find evidence consistent with keeping up with the Joneses behavior in stock market participation: individual market participation increases with average community market participation.

Although we do not perform any direct test on portfolio holdings in this paper,[3] the KEEPM yields partial equilibrium results that are consistent with those in the home bias at home literature: investors shun distant assets while favoring local assets. However, it is important to stress that the argument behind the portfolio tilt in our paper is neither familiarity nor information, but hedging: local assets offer a hedge for the risk to local investors resulting from the non-diversifiable income of their peers.[4]

2 The KEEPM

In this section, we present the main testable implications from the KEEPM. For a more detailed derivation, see Gómez, Priestley and Zapatero (2008). We assume a one-period economy. Agents in this economy live in a two-division country: they either live in the north, n, or the south, s. There exists a firm that produces a global good, tradable across divisions. Consumption of the global good is denoted by c and takes place at the end of the period, $t = 1$.

In each division, there are two types of agents: "investors" and "workers." At time $t = 0$, investors are endowed with shares of the firm that produces the global good. For simplicity, we normalize the aggregate value of those shares in each division to one. Workers in each division are endowed with human capital that produces a fixed number, $\bar{w}$, of units of the local good at time $t = 1$.[5] Workers face incomplete markets because they cannot trade their human capital (due, for instance, to moral hazard and short-selling constraints) and have no access to financial markets; therefore, they cannot hedge their income risk. In addition to the firm's shares, there are as many zero net supply stocks as needed for financial markets to be complete. Let r denote the stocks excess return with finite moments $E(r)$ and Ω. The bond (in zero net supply) has gross return R.

As mentioned in the introduction, there are two possible ways in which relative wealth concerns may arise in equilibrium: endogenously, via local inflation risk-hedging, and exogenously, whereby investors derive utility from consumption relative to their peers. In the endogenous case, agents' utility over consumption for the two goods is given by:

$$u(c, w) = \frac{1}{1-\alpha}(c^{1-\alpha} + \delta w^{1-\alpha}).$$

The parameter $\delta > 0$ specifies the relative importance of the local good; $\alpha > 0$ is the relative risk aversion parameter. DeMarzo, Kaniel and Kremer (2004) show that, in equilibrium, the relative price of the local good in terms of the global good at $t = 1$ is given by $p = \delta \left(\frac{c}{\bar{w}}\right)^{\alpha}$. As expected, the scarcer the (fixed)

[3] See, for instance, Michaud (1989). Brandt (2004) surveys the literature.

[4] In empirical tests that are not report in this paper, we have verified that the relevant risk factor is the correlation of the security with the idiosyncratic local (divisional) component of labor income, regardless of where the security is located.

[5] The term "workers" is widely defined in our model: it includes holders of all kind of human capital that materializes, for instance, in wage income or entrepreneurial income.

local good endowment relative to the (stochastic) global good consumption, the higher the relative price of the former. Investor's hedging demand against this inflationary risk will result in a local portfolio bias.

Let θ represent the relative wealth at $t = 0$ of the division's workers as a proportion of the total division's wealth. Under complete (financial) markets, there exists a portfolio X^w such that the return on the workers wealth (in units of the global good) over the period can be written as $R + r'X^w$. After these definitions, Gómez, Priestley and Zapatero (2008) show that the approximate function for the investor's optimal portfolio in division $k \in \{n, s\}$ will be:

$$x_k^* = \theta_k b_k X_k^w + \tau_k \, \Omega^{-1} E(r), \tag{1}$$

where the parameters $b_k = \frac{\alpha_k - 1}{\alpha_k}$ and $\tau_k = 1/\alpha_k$ represent the portfolio bias and the risk-tolerance coefficient, respectively. Notice that the optimal portfolio for the logarithmic investor ($\alpha = 1$) coincides with the benchmark, well diversified portfolio $\Omega^{-1}E(r)$. No relative wealth concern arises even in the presence of local, non-diversifiable wealth.

In the exogenous case, the representative investor is endowed with an utility function

$$u(c, C) = \frac{c^{(1-\alpha)}}{1-\alpha} C^{\gamma\alpha},$$

where C is the division average or per capita consumption and $1 > \gamma \geq 0$ is the "Joneses parameter." For $\gamma > 0$, the constant average consumption elasticity of marginal utility (around the symmetric equilibrium), $\alpha\gamma$, is positive as well: increasing the average consumption per capita C makes the individual's marginal consumption more valuable since it helps her to "keep up with the Joneses." In short, we assume the division's average consumption to be a positive consumption externality.

Gómez, Priestley and Zapatero (2008) show that the investor's optimal portfolio in the exogenous case coincides with equation (1) with parameters $b_k = \frac{\gamma_k}{1-\gamma_k}$ and $\tau_k = \frac{1}{\alpha_k(1-\gamma_k)}$. Hence, whether endogenously or exogenously driven, both specifications lead to the same testable implications in equilibrium, the only difference being the interpretation of the parameters b and τ.

Let ω_k be the weight of division k in the market clearing portfolio, $x_M = (\omega_n, \omega_s)'$, with variance σ_M^2. We regress the workers non-diversifiable wealth return, $r_k^w = r'X_k^w$, onto the market portfolio return plus a constant:

$$r_k^w = a_k + \beta_k \, r_M + \xi_k. \tag{2}$$

Portfolio $\beta_k \, x_M$ represents the projection of the workers income onto the security market line spanned by the market portfolio x_M. Define the portfolio $F_k \equiv X_k^w - \beta_k \, x_M$ as a "residual" factor portfolio with return $r_k^F = r'F_k$. Define the matrix $\boldsymbol{F}$ of dimension $N \times 3$ as the column juxtaposition of the market portfolio and the orthogonal portfolios, $\boldsymbol{F} \equiv (x_M, F_n, F_s)$.

Given equations (1) and (2), Gómez, Priestley and Zapatero (2008) show that, in equilibrium, after market clearing,

$$E(r) = \boldsymbol{\beta} \, \boldsymbol{\lambda}, \tag{3}$$

where $\boldsymbol{\beta} = \Omega\,\boldsymbol{F}\,(\boldsymbol{F}'\Omega\,\boldsymbol{F})^{-1}$ denotes the 2×3 (in general $N \times (1 + K)$, with N the number of assets and K the number of divisions) matrix of betas, with the first column as the market betas for both assets.

This pricing model is the KEEPM, which stands for "KEEping up Pricing Model." The model has testable implications for the risk premia ($\boldsymbol{\lambda}$). Concretely, the model predicts:

$$\lambda^M = H\left(1 - \sum_k \omega_k\theta_k\, b_k\,\beta_k\right)\sigma_M^2,$$

$$\lambda^n = -H\left(\omega_n\theta_n\, b_n\,\mathrm{Var}(r_n^F) + \omega_s\theta_s\, b_s\,\mathrm{Cov}(r_n^F, r_s^F)\right), \tag{4}$$

$$\lambda^s = -H\left(\omega_n\theta_n\, b_n\,\mathrm{Cov}(r_n^F, r_s^F)) + \omega_s\theta_s\, b_s\,\mathrm{Var}(r_s^F)\right), \tag{5}$$

with $H^{-1} = \sum_k \omega_k\tau_k$ the market-weighted risk-tolerance coefficient. The country market portfolio, x_M, is partially correlated with each division's non-diversifiable risk. This is captured by the coefficient β_k. That correlation offers partial hedging against deviations from the local, non-tradable risk. Furthermore, if there is a relative wealth concern ($b > 0$) in the economy and workers income is not diversifiable ($\theta > 0$), there are two additional risk factors together with the market risk factor. Regarding their sign, the model predicts that if $\mathrm{cov}(r_n^F, r_s^F) > 0$, then λ^n and λ^s will be negative. The intuition for the negative sign is as follows: An asset that has positive covariance with portfolio F_k will hedge the investor in division k from the local, non-diversifiable income risk. The investor will be willing to pay a higher price for this asset thus yielding a lower expected return. In equilibrium, the price of risk for F_k would be, in absolute terms, increasing in b_k and the volatility of the hedge portfolio. If the covariance between both zero-beta portfolios is positive, this just increases the absolute value of the negative prices of risk for every division's hedge portfolio.

In summary, the presence of endogenous or exogenous Joneses imply that, besides the market risk premium, investors require a premium for holding stocks with no, or negative, correlation with the non-hedgeable local labor or entrepreneurial income. In addition, investors are willing to give up expected returns (that is, pay a premium) for the stocks that are correlated with the idiosyncratic component of the local risk and, therefore, help them to hedge against this risk. This result depends in a fundamental way on the market friction that prevents some agents (our workers) from participating in the markets.

3 Empirical Results

3.1 Data description

The model does not specify the dimension of "the peers." Our choice, the nine Census divisions, is a compromise between the scale of relative wealth concerns and the existence of a sufficiently large number of firms for the cross sectional tests. To proxy local (ie., divisional) wealth, we use personal income from the Bureau of Economic Analysis (BEA). The BEA provides quarterly personal income data at the state level. We calculate per capita personal income data at the divisional level using data on annual population in each division (aggregated from state level population data) from the U.S. Census Bureau. There are nine Census Bureau Divisions which we index with two capital letters: West South Central

(WS), Pacific (PA), East South Central (ES), Mountain (MO), East North Central (EN), South Atlantic (SA), West North Central (WN), Middle Atlantic (MA), NE is New England (NE).[6] The model predicts that the component of personal income orthogonal to the aggregate stock market return will be priced with a negative risk premium if investors have keeping up with the Joneses preferences, or if there exist local goods in short supply whose possible price increase agents wish to hedge. To this end, we regress the divisional level personal income on the CRSP aggregate stock market excess return and employ the residuals from this regression.

The data on stock returns and firm characteristics come from CRSP and COMPUSTAT. We consider all firms in COMPUSTAT/CRSP from 1963 to the end of 2006. From CRSP, we obtain stock returns for NYSE, AMEX and NASDAQ stocks. From COMPUSTAT, we obtain annual information on headquarter location, market capitalization and book value of equity. Using the information on headquarters location in COMPUSTAT, each firm is assigned into one of the nine divisions.

First, we want to study whether there exists a negative risk premium associated with stocks that are highly correlated with orthogonal labor income. Within each division we form a factor mimicking portfolio of the orthogonal component of divisional labor income with respect to the market stock returns. Starting in 1960 we use five years of quarterly data and regress individual stock returns on a constant and on local orthogonal labor income. We use this coefficient, estimated until the fourth quarter of 1964 to rank stocks in 1965. Next we form three equally weighted portfolios according to the size of the coefficient. We then add one year of data, re-estimate the coefficient, and then rank stocks, form portfolios and compute their returns in 1966. We continue adding one year and re-estimating the coefficients until we have thirty-six quarterly observations in the regressions. At this point we start rolling the data one year at a time: adding on a new year and taking off the first year. We continue this process until the end of the sample.

The above procedure provides three portfolios from the first quarter of 1965 to the final quarter of 2006 which are formed in year t based on the estimated coefficient on orthogonal labor income estimated until year $t-1$. The returns of such a factor mimicking portfolio are computed as the returns of the portfolio formed by the stocks with the highest one third of coefficient estimates minus the returns on the portfolio formed by the stocks with the lowest one third of coefficient estimates.

The next step involves the choice of test assets. Daniel and Titman (2005) and Lewellen, Nagel, and Shanken (2008) note that testing asset pricing models using firm characteristics to form portfolios can lead to spurious conclusions about the usefulness of a proposed factor. The reason for this is that the factor structure of the portfolios is so strong that any proposed factor that is only weakly correlated with size or book-to-market will be able to price the test assets. That is, testing a new proposed factor on test assets sorted by size and book-to-market is likely to have very low power.

In order to alleviate this concern we follow the recommendations in Daniel and Titman (2005) and Lewellen, Nagel, and Shanken (2008) and sort stocks by lagged loadings on our proposed factor.

To generate the test assets we repeat the previous procedure and calculate twenty equally weighted portfolios for each division, (except for the East south Central division where we calculate ten portfolios due to the small number of stocks in this division in the early part of the sample). In addition, for our robustness exercises, we sort stocks in each division in year t into twenty portfolios according to market

[6] We include a map of the nine US Census divisions in Figure 1.

capitalization at the end of year $t-1$.

We calculate excess returns on all the test asset portfolios by subtracting the one month T-bill rate from the actual returns. In addition to the local risk factors we also require the excess return on the aggregate stock market portfolio (*erm*), as proxied by the CRSP aggregate index. We compare the performance of our model to that of the Fama-French three factor model that uses the excess return on aggregate stock market portfolio, the small minus big (*smb*) portfolio and the high minus low (*hml*) book to market portfolio. The premia on *erm*, *smb* and *hml* are 1.50%, 1.07% and 1.07% respectively, per quarter, over the sample period.

3.2 Main Results

Table 1 reports the means of the factor mimicking portfolios annualized returns in each division, along with their t-statistics. In order to compare our results with Hong, Kubik and Stein (2008), we order the divisions according to population density. Divisions with low population density (less than 100 individuals per square mile) are indicated with a "(L)" following their two-letter symbol.[7] First, we observe that, as predicted by the model, all the risk premia are negative, suggesting that investors are willing to pay a premium in order to hold stocks that are strongly and positively correlated with the orthogonal component of labor income relative to those that have low or negative correlation. The mean premia range from an annual -2.84% in the EN division to -7.39% in MO. Table 1 also reveals a pattern of higher (in absolute value) risk premia in low population density divisions compared to divisions with high population density. Moreover, according to the t-statistics, the risk premia are marginally statistically significant in SA and EN, and statistically significant in low density divisions, with the exception of ES. A possible explanation of the fact that risk premia are larger (in absolute value) in low population divisions is that Keeping up with the Joneses preferences are "stronger" in these divisions, that is, the Keeping up with the Joneses parameter γ of section 2 is higher in divisions with lower population density. The reason for that could be that in areas with lower density is easier to identify the peer group, as well as to assess their level of wealth, as opposed to areas of higher density, where the notion of "Joneses" can be elusive.[8]

Panel B of Table 1 reports the covariances (lower triangular matrix), variances, and correlations (upper triangular matrix) amongst the factor mimicking portfolios. Since the number of stocks in each division is not always large, the variances are often high (for example, in comparison with the *smb* and *hml* factor mimicking portfolios, six divisions have a larger variance). The covariances, and in particular the correlations, show that the factor mimicking portfolios are highly correlated. Because of this we estimate the asset pricing model division by division in order to avoid multicollinearity.

[7] Population density numbers are: MA, 399; NE, 222; SA, 194; EN, 185; PA, 136; ES, 95; WS, 74; WN, 38; MO, 21. As Harrison, Kubik and Stein (2008), we have excluded Alaska and Hawaii to compute the density of PA.

[8] ES is peculiar in several respects. It has lower population and a substantially lower number of firms than other divisions, as we argued before. More importantly, it is the poorest division on a GDP per capita basis. Out of the four states in this division, in the BEA statistics for 2007, Mississippi ranked dead last among all 50 US states, and Tennessee, Kentucky and Alabama ranked 40, 41 and 44, respectively. From equation (5), wealth is a factor in the determination of the size of the risk premium. The low level of wealth of this division can offset the effect of the Keeping up with the Joneses preferences.

3.3 Time Series Regressions

We begin the empirical analysis with the standard asset pricing test of Black, Jensen and Scholes (1972). We also want to explore if the factor mimicking portfolio of the orthogonal component local labor income of our model is important in the presence of the three Fama-French factors. In particular, we estimate the following time series regression:

$$r_{i,k,t} = \alpha_{i,k} + b_{i,k} erm_t + s_{i,k} smb + h_{i,k} hml_t + l_{i,k} ly_{k,t} + u_{i,k,t} \tag{6}$$

where $r_{i,k,t}$ is the excess return on portfolio i ($i = 1, ..20$) from division k ($k = 1, ..9$) at time t; $\alpha_{i,k}$ is the division-specific constant; $b_{i,k}$ is the estimated factor loading on erm (excess return on the market portfolio); $s_{i,k}$ is the estimated factor loading on smb (the small-minus-big Fama-French factor); $h_{i,k}$ is the estimated factor loading on hml (the high-minus-low Fama-French factor); $l_{i,k}$ is the estimated factor loading on ly, the factor mimicking portfolio for orthogonal local labor income; finally, $u_{i,k,t}$ is the error term for division k.

The cross sectional asset pricing implications of the model are assessed by testing whether the estimated intercepts are jointly significantly different from zero. To this end we use the Gibbons, Ross and Shanken (1989) (GRS) test:

$$GRS = \frac{T-N-K}{N}\left[1+\mu'\Omega^{-1}\mu\right]^{-1}\widehat{\alpha}'\Sigma^{-1}\widehat{\alpha} \rightarrow F(N, T-N-K) \tag{7}$$

where T is the number of observations, N is the number of test portfolios, K is the number of factors, μ and Ω are the sample mean and covariance matrix of the factor returns, $\widehat{\alpha}$ is the vector of estimated intercepts, and Σ is the variance-covariance matrix of the time series regression residuals. The term in brackets adjusts for the sampling error in the estimates of the factor loadings.

Table 2 reports the estimates, division by division, of equation (6). The divisions are listed according to their population density ranking, starting with the most dense, MA, in Panel A, to the least dense, MO, in Panel I. In panel A we observe that the estimated intercepts are small and only statistically significant in three cases, one of them marginally. The GRS test statistic cannot reject the null hypothesis that intercepts are jointly zero.

The coefficients on the factor mimicking portfolio of the local component (orthogonal) of labor income are positive for the first eight portfolios (portfolio 1 is the portfolio with the highest coefficients on the local labor income whilst portfolio 20 is the portfolio with the lowest coefficients) and in seven cases they are statistically different from zero. Portfolios nine through twenty have negative coefficient estimates on the factor mimicking portfolio and eleven are statistically significant. The estimates, both negative and positive, are large economically and generally decrease monotonically from portfolio 1 to portfolio 20. The patterns in the estimated betas clearly illustrate that the stocks with a high correlation with the orthogonal component of divisional labor income are stocks that investors are willing to pay a premium to hold. Their positive betas indicate that they command a lower expected return, even after controlling for the three Fama and French factors. For those stocks that are not highly correlated, and have a negative beta, investors require an additional premium to hold them. These results are consistent with the EHF model and the local good in short supply model.

Columns four to six report the estimates on the *erm*, *smb*, and *hml* factors respectively. In most cases they are statistically significant. Therefore, it appears that the factor mimicking portfolio for the orthogonal component of local (divisional) labor income captures variations in returns that are independent of the Fama-French three factors. Also note that there is no monotonic pattern in the Fama-French three factors across the twenty portfolios, suggesting that local labor income is independent of the Fama-French sources of risk. The adjusted R^2, $\overline{R}^2$, is large, ranging from 0.76 to 0.89, indicating that most of the time series variation in the portfolio returns is captured by the four factors.

The remaining panels of Table 2 show that the results of the MA division hold on all the other divisions. Only in the SA division it is possible to marginally reject the null hypothesis that all intercepts are jointly zero. For the low population density the intercepts are even smaller, with strong GRS statistics in favor of the null hypothesis that the intercepts are jointly zero. As noted before, population density seems a factor in the validation of the KEEPM to explain stock returns, although $\overline{R}^2$ is in general smaller than for high density regions.

An important observation from Table 1 is the high correlation among the factor mimicking portfolios across the different divisions. So far we have documented differences between regions with low and high population density. However, given the high correlations among the mimicking portfolios, it is not clear whether investors are hedging local or global (domestic) risk. With that question in mind, we form a "global" (at the domestic level) mimicking portfolio that is calculated using the methodology previously described, but with the orthogonal component of aggregate (as opposed to divisional) labor income. The annual mean premia corresponding to Panel A of Table 1 is -5.15% with a t-statistic of 2.55. It is interesting to note that the t-statistic on the global orthogonal labor income factor is highly statistically significant. In addition, in Table 3 we report the estimates of equation (6) for the portfolios of each division with respect to this global mimicking portfolio, as well as the GRS test statistics. The results are very similar to those of Table 2: we find that most estimated coefficients on the global orthogonal labor income factor are statistically significant; the Fama-French risk factors are significant, but appear independent of the labor income factor we explore here; intercepts are very small, especially for divisions with low population density. Th $\overline{R}^2s$ are large in general, but smaller for low-density divisions. Overall, we cannot conclude whether the risk factor is of a local or global (domestic) nature. We explore this issue further in the next subsection.

3.4 Cross-Sectional Regressions

According to the asset pricing implications of the model, local (divisional) risk factors that proxy for orthogonal local wealth should be priced in the cross-section of stock returns with a negative risk premium. In order to test this we use the cross-sectional methodology of Fama and MacBeth (1973). In particular, we consider the following pricing equation for the expected return of each stock or portfolio in a given division,

$$E(r_i) = \lambda^0 + \lambda^m b_i + \lambda^{smb} s_i + \lambda^{hml} h_i + \lambda^{ly} l_i, \tag{8}$$

where, using the notation of equation (6), $E(r_i)$ is the expected return on asset i, λ^m is the market price of risk, b_i is the coefficient on *erm* for stock i, λ^{smb} is the price of risk associated with the *smb* factor,

s_i is the coefficient on smb, λ^{hml} is the price of risk associated with the hml factor, h_i is the coefficient on hml, and λ^{ly} is the price of risk associated with the orthogonal local (divisional) labor income factor mimicking portfolio. The model predicts that $\lambda^{ly} < 0$.

The Fama and MacBeth (1973) procedure involves a first step in which time series regressions are used to estimate the betas, and a second step in which cross-sectional regressions are used to estimate the prices of risk. When data is available over a long sample period it is usual to undertake a rolling regression approach by using sixty observations up to time t in the first step to obtain the first beta; then this beta is used in the second step to estimate a cross-sectional regression of average returns at time $t + 1$ on the beta estimated until time t. The data is then rolled forward one month and the procedure is repeated. This results in a time-series of cross section estimates of the market price of risk. However, this rolling procedure is not appropriate when using quarterly time series data over a relatively short sample. Rather, the beta coefficients are estimated over the entire sample and used in all of the T cross-sectional regressions. This is the method recommended by Lettau and Ludvigson (2001) who employ quarterly data and is discussed in Cochrane (2005).

In our assessment of the cross-sectional performance of the KEEPM, we first consider whether the estimated division risk factors are negative and statistically significant and, in addition, if they can explain the variation in returns across the test assets. In Table 4 we report the average risk premia for the test securities of each division, that is, we derive the result of equation (6) for each division. More precisely, for each division we use Fama-MacBeth with the testing assets on the left-hand side of equation (8) and the corresponding risk factors loadings on the right hand-side: the factor loading on the local (divisional) component of labor income (measured through the correlation with the local mimicking portfolio) and the loadings on the three Fama-French factors. We do not report the results for division ES because it does not have enough securities to get adequate variation in the cross-section of returns.

It is evident from Table 4 that the local income risk factor is negative in all regions, and statistically significant in the low density regions. It is also marginally significant in the NE, SA and EN divisions, although the estimated prices of risk are smaller than in the low population density divisions. In contrast, the Fama-French factors are not significant, in general, even in the regions with low density (with the exception of hml in WS). In addition, we report the adjusted R^2 ($\overline{R}^2$) for the model with only the three Fama-French factors, and the model including the local income risk factor. Adding the local risk-factor increases the $\overline{R}^2$ in all regions except one, in some cases substantially.[9]

3.5 The Role of Local and Global Orthogonal Labor Income

Given the high correlation of the orthogonal local labor income, one possibility that we have ignored so far in the cross sectional regressions is that investors care about wealth relative to aggregate (global) orthogonal labor income, and not to divisional (local) orthogonal labor income. In order to assess this, we perform a similar exercise to the cross-sectional regressions in the previous section, but on the right-hand side of equation (6) we replace the local income risk factor (one for each division, proxied by the

[9]Following Jagannathan and Wang (1996) and Lettau and Ludvigson (2001), we calculate R^2 as $[Var_c(\overline{r}_i) - Var_c(\overline{e}_i)]/Var_c(\overline{r}_i)$, where Var_c is the cross-sectional variance, $\overline{r}_i$ is the average return and $\overline{e}_i$ is the average residual.

corresponding mimicking portfolio) with the global (domestic) risk factor, common to all regions (and proxied by the corresponding mimicking portfolio).

Table 5 reports our findings. As in the case of Tables 2 and 3, the results are similar to those of Table 4, which is again due to the high correlation among local income risk factors (more precisely, the corresponding mimicking portfolios). However, the prices of risk have less variability across divisions than in Table 4. For example, in the high population density divisions the average price of risk when using the local orthogonal labor income factor is 0.790. When using the global factor the average is almost one. Regarding the low population density divisions, the averages across the divisions are almost identical.

To further explore this issue, in Table 6 we include both the divisional income risk factor (proxied by the corresponding mimicking portfolios) and the global income risk factor (proxied by the corresponding mimicking portfolio). The risk premia of the local risk factor are very similar to those of Table 4, both in size and statistical significance. However, the risk premia corresponding to the global risk factor now becomes statistically irrelevant. In summary, it appears that the local orthogonal risk factor is more important than the global factor.

3.6 Robustness Tests

Thus far, we have focused on the ability of orthogonal labor income to describe the cross section of returns of portfolios formed based on lagged factor loadings. As noted in the data section, according to Daniel and Titman (2005) and Lewellen, Nagel and Shanken (2008) this methodology is preferred to testing asset pricing models based on portfolios sorted according to size and book to market. However, for robustness purposes, we augment the twenty portfolios of each division formed on lagged factor loadings with twenty additional portfolios formed at time t according to market capitalization at time $t-1$.

We report the results in Table 7. Note that in this case we include the ES division, for which we use ten portfolios formed on the lagged risk factor loadings (divisional labor income) and ten portfolios based on size, but the estimates are not significant. With respect to the other divisions, the results corroborate our conclusions from the previous tables. In five cases $\overline{R}^2$ is higher than when we use lagged factor loading portfolios and the Fama-French factor portfolios as test assets, and in another two is very similar.

4 Conclusions

Relative wealth concerns can lead to an equilibrium in which securities that load on a local non-diversifiable risk factor have a negative risk premium. This premium reflects the price investors are willing to pay to keep up with the Joneses. It may arise in equilibrium either endogenously (via local price inflation risk-hedging) or exogenously (preference driven: people directly care about relative consumption). Either way, a multifactor asset pricing model arises: the KEEPM ("KEEping up Pricing Model").

We consider the impact of relative wealth for portfolios of securities for the nine US Census divisions, using labor income return as a source of non-diversifiable local risk. We find strong empirical support for our conjecture: prices of risk for the local non-diversifiable risk are negative and often statistically significant across divisions.

We also report that the size (in absolute terms) of the prices of risk are larger for those divisions with smaller population density. This is related to the finding in Hong, Kubik and Stein (2008), who show that population density is negatively correlated with stock prices. A possible explanation is that relative wealth concerns are stronger in areas with low population density because, for example, it is easier to identify the reference group (the "Joneses") with respect to which each particular investor has relative wealth concerns. Alternatively, lower density may imply higher competition for assets in short supply (like human capital) and, therefore, a stronger desire to hedge the corresponding inflationary risk.

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Table 1

Factor Risk Premia

Panel A: Mean Returns

	MA	NE	SA	EN	PA	ES(L)	WS(L)	WN(L)	MO(L)
r_k^F	-2.89	-2.88	-3.98	-2.84	-3.73	-3.03	-6.13	-4.97	-7.39
t-stat	1.45	1.54	1.85	1.96	1.47	1.34	2.22	2.50	2.62

Panel B: Variances, Covariances and Correlations

	MA	NE	SA	EN	PA	ES(L)	WS(L)	WN(L)	MO(L)
MA	0.0040	0.5121	0.6801	0.5691	0.7266	0.4620	0.6589	0.5662	0.5121
NE	0.0019	0.0035	0.4652	0.4832	0.5940	0.2893	0.4332	0.4967	0.3177
SA	0.0029	0.0018	0.0046	0.5583	0.6699	0.5964	0.6301	0.5464	0.5590
EN	0.0016	0.0013	0.0017	0.0022	0.5140	0.4430	0.5869	0.6003	0.3782
PA	0.0037	0.0028	0.0036	0.0019	0.0029	0.0050	0.4190	0.4657	0.3876
ES(L)	0.0020	0.0012	0.0028	0.0014	0.0028	0.0025	0.0076	0.6233	0.5557
WS(L)	0.0036	0.0022	0.0037	0.0024	0.0045	0.0028	0.0045	0.5794	0.4588
WN(L)	0.0022	0.0018	0.0023	0.0017	0.0029	0.0020	0.0034	0.0039	0.4847
MO(L)	0.0028	0.0016	0.0033	0.0015	0.0032	0.0024	0.0043	0.0027	0.0078

Table 2
Regression of Excess Returns on Mimicking Portfolios
Panel A: MA

	α_A	β^{MA}	β_{erm}	β_{smb}	β_{hml}	R^2
P1	-0.009	0.419***	0.999***	1.380***	0.093	0.76
P2	-0.001	0.384***	0.839***	1.141***	0.137	0.76
P3	-0.001	0.409***	0.875***	0.992***	0.170***	0.85
P4	0.001	0.271***	0.879***	0.974***	0.111	0.77
P5	-0.005	0.276***	0.873***	0.885***	0.307***	0.78
P6	-0.002	0.174***	0.828***	0.702***	0.224***	0.82
P7	-0.008***	0.167***	0.815***	0.729***	0.345***	0.85
P8	-0.008**	0.107	0.896***	0.789***	0.389***	0.82
P9	-0.001	-0.149**	0.812***	0.583***	0.298***	0.81
P10	-0.005	-0.227***	0.921***	0.530***	0.429***	0.84
P11	0.001	-0.283***	0.798***	0.718***	0.389***	0.85
P12	-0.006*	-0.092	0.896***	0.765***	0.399***	0.87
P13	-0.004	-0.134*	0.879***	0.878***	0.362***	0.85
P14	-0.002	-0.553***	0.798***	0.705***	0.266***	0.85
P15	-0.005	-0.408***	0.886***	0.821***	0.329	0.88
P16	-0.004	-0.770***	0.818***	0.878***	0.296***	0.87
P17	0.000	-0.698***	0.859***	0.972***	0.066	0.89
P18	0.001	-0.691***	0.843***	0.971***	0.213***	0.87
P19	-0.007	-0.582***	0.992***	1.110***	0.218**	0.86
P20	-0.009	-1.076***	0.956***	1.368***	0.041	0.87
GRS Test	1.316 [0.21]					

Panel B: NE

	α_A	β^{NE}	β_{erm}	β_{smb}	β_{hml}	R^2
P1	-0.010	0.811***	1.083***	1.702***	0.082	0.67
P2	0.000	0.536***	1.030***	0.971***	0.183**	0.77
P3	0.008	0.540***	0.974***	1.242***	0.128	0.77
P4	0.002	0.369***	0.951***	1.042***	0.125	0.76
P5	-0.005	0.334***	0.926***	0.964***	0.188**	0.80
P6	-0.010**	0.083	0.899***	0.716***	0.416***	0.75
P7	-0.002	0.109	0.833***	0.700***	0.197**	0.71
P8	0.007	0.073	0.696***	0.878***	0.206**	0.62
P9	-0.004	0.075	0.772***	0.878***	0.410***	0.71
P10	-0.004	0.108	0.854***	0.851***	0.272***	0.77
P11	-0.006	-0.163*	0.850***	1.016***	0.485***	0.78
P12	-0.008*	-0.039	1.058***	0.716***	0.528***	0.78
P13	-0.002	-0.159	1.017***	0.890***	0.453***	0.77
P14	-0.003	-0.400***	1.019***	0.910***	0.482***	0.78
P15	0.0182**	-0.984***	0.823***	0.852***	-0.141	0.72
P16	0.001	-0.426***	0.956***	0.989***	0.439***	0.74
P17	-0.006	-0.405***	0.996***	1.069***	0.258***	0.79
P18	-0.013**	-0.461***	0.995***	1.067***	0.200**	0.77
P19	0.001	-0.416***	0.908***	1.495***	0.050	0.75
P20	-0.011	-0.663***	1.058***	1.459***	0.056	0.79
GRS Test	1.477 [0.10]					

Panel C: SA

	α_A	β^{SA}	β_{erm}	β_{smb}	β_{hml}	R^2
P1	-0.009	0.626***	0.993***	1.687***	0.074	0.61
P2	-0.008	0.481***	0.945***	0.803***	0.215**	0.64
P3	-0.001	0.358***	0.849***	0.983***	0.388***	0.73
P4	-0.011***	0.328***	0.883***	0.845***	0.444***	0.75
P5	-0.003	0.150*	0.876***	0.671***	0.431***	0.75
P6	-0.010**	0.154	0.910***	0.755***	0.555***	0.74
P7	0.001	0.028	0.927***	0.583***	0.560***	0.77
P8	-0.011***	0.113	0.833***	0.719***	0.434***	0.80
P9	-0.001	-0.001	0.934***	0.681***	0.418***	0.74
P10	0.004	-0.077	0.776***	0.687***	0.491***	0.70
P11	-0.001	-0.140	0.945***	0.665***	0.403***	0.74
P12	-0.007	-0.286***	0.877***	0.803***	0.453***	0.79
P13	-0.005	-0.083***	0.942***	0.806***	0.519***	0.74
P14	-0.006	-0.381***	0.842***	0.871***	0.416***	0.80
P15	-0.007	-0.463***	0.878***	0.782***	0.503***	0.81
P16	-0.002	-0.614***	1.002***	0.711***	0.428***	0.83
P17	-0.007	-0.445***	0.918***	0.932***	0.368***	0.82
P18	0.004	-0.820***	0.884***	0.850***	0.255***	0.84
P19	-0.013*	-0.746***	0.913***	1.396***	0.310**	0.77
P20	-0.014*	-1.216***	0.918***	1.061***	0.276***	0.80
GRS Test	1.628 [0.06]					

Panel D: EN

	α_A	β^{EN}	β_{erm}	β_{smb}	β_{hml}	R^2
P1	-0.002	0.580***	0.921***	1.214***	0.296***	0.79
P2	0.001	0.691***	0.827***	1.094***	0.255***	0.79
P3	-0.006	0.361***	0.889***	0.792***	0.453***	0.82
P4	-0.007**	0.233***	0.943***	0.537***	0.405	0.81
P5	-0.006*	0.304***	0.852***	0.596***	0.374***	0.80
P6	-0.007**	0.078	0.895***	0.507***	0.461***	0.82
P7	-0.002	-0.031	0.792***	0.470***	0.356***	0.79
P8	-0.005*	-0.084	0.733***	0.453***	0.382***	0.78
P9	-0.005*	-0.179**	0.772***	0.437***	0.412***	0.80
P10	-0.004	-0.287***	0.812***	0.461***	0.303***	0.81
P11	-0.006*	-0.327***	0.792***	0.456***	0.323***	0.78
P12	-0.005	-0.221	0.826***	0.452***	0.362***	0.79
P13	-0.003	-0.432***	0.822***	0.551***	0.335***	0.83
P14	-0.002	-0.573***	0.832***	0.518***	0.417***	0.84
P15	-0.007*	-0.634***	0.873***	0.495***	0.436	0.84
P16	-0.004	-0.399***	0.971***	0.573***	0.515***	0.85
P17	-0.003	-0.399***	0.971***	0.573***	0.515	0.85
P18	-0.005	-0.709***	0.827***	1.066***	0.290***	0.89
P19	-0.001	-0.742***	0.834***	0.956***	0.257***	0.85
P20	-0.005	-0.861***	0.957***	1.059***	0.298***	0.80
GRS Test	0.562 [0.93]					

Panel E: PA

	α_A	β^{PA}	β_{erm}	β_{smb}	β_{hml}	R^2
P1	-0.005	0.599***	1.195***	1.408***	-0.121	0.69
P2	0.001	0.380***	0.953***	1.154***	-0.056	0.70
P3	0.000	0.291***	1.066***	0.927***	0.069	0.75
P4	-0.004	0.179**	1.042***	0.762***	0.206**	0.72
P5	0.004	0.162**	0.913***	1.091**	0.130	0.78
P6	-0.007	0.134*	0.942***	0.759***	0.144	0.72
P7	-0.002	0.061	0.892***	0.865***	0.232***	0.77
P8	-0.004	-0.111	0.965***	0.904***	0.479***	0.77
P9	0.004	-0.144*	0.937***	0.824***	0.148*	0.78
P10	0.002	-0.093	0.911***	1.020***	0.194*	0.70
P11	0.001	-0.156	0.780***	1.204***	0.268**	0.65
P12	0.005	-0.434***	0.976***	0.684***	0.300***	0.78
P13	-0.004	-0.282***	1.072***	0.763***	0.419***	0.84
P14	-0.003	-0.269***	1.054***	0.930***	0.212***	0.86
P15	-0.001	-0.692***	1.036***	0.888***	0.194*	0.82
P16	0.003	-0.767***	0.801***	0.968***	-0.158	0.80
P17	-0.017***	-0.568***	1.128***	1.041***	0.518***	0.84
P18	0.001	-0.728***	0.941***	1.062***	-0.132	0.81
P19	-0.010	-0.808***	1.039***	1.087***	0.005	0.79
P20	0.002	-1.053***	1.049***	1.109***	-0.088	0.77
GRS Test	1.133 [0.32]					

Panel F: ES(L)

	α_A	β^{ES}	β_{erm}	β_{smb}	β_{hml}	R^2
P1	-0.001	0.656***	0.923***	1.012***	0.395***	0.60
P2	0.001	0.412***	0.822***	0.712***	0.661***	0.59
P3	-0.005	0.185***	0.765***	0.393***	0.376***	0.63
P4	-0.002	-0.029	0.685***	0.594***	0.321**	0.55
P5	-0.002	-0.066	0.776***	0.589***	0.464***	0.55
P6	-0.001	-0.162	0.939***	0.944***	0.532	0.59
P7	0.005	-0.239**	0.713***	0.767***	0.423***	0.61
P8	0.003	-0.667***	0.852***	0.599***	0.379***	0.74
P9	-0.007	-0.183*	0.984***	0.875***	0.569***	0.67
P10	0.014*	-0.852	0.756***	0.752***	0.606***	0.73
GRS Test	1.101 [0.36]					

Panel G: WS(L)

	α_A	β^{WS}	β_{erm}	β_{smb}	β_{hml}	R^2
P1	-0.007	0.797***	1.008***	1.354***	0.148	0.62
P2	-0.006	0.971***	1.174***	1.318***	0.504**	0.64
P3	-0.001	0.845***	1.011***	0.998***	0.406**	0.60
P4	0.001	0.708***	0.777***	0.968***	0.168*	0.66
P5	0.000	0.568***	0.791***	0.802***	0.317***	0.60
P6	-0.004	0.479***	0.879***	0.611***	0.418***	0.61
P7	-0.002	0.566***	0.922***	0.790***	0.506***	0.63
P8	-0.002	0.388***	0.866***	0.618***	0.370***	0.62
P9	-0.001	0.350***	0.754***	0.787***	0.444***	0.49
P10	0.005	0.216***	0.842***	0.659***	0.501*	0.61
P11	0.005	0.229***	0.861***	0.619***	0.400***	0.65
P12	0.006	0.088	0.813***	0.909***	0.261***	0.59
P13	0.001	0.037	1.021***	0.794***	0.501**	0.69
P14	0.002	0.065	1.014***	0.721***	0.435***	0.69
P15	-0.005	-0.191**	0.929***	0.692***	0.439***	0.65
P16	-0.001	-0.244***	1.028***	0.790***	0.263**	0.64
P17	0.004	-0.226**	0.877***	1.009***	0.614**	0.66
P18	0.001	-0.346***	0.862***	1.258***	0.344***	0.76
P19	-0.011	-0.437***	0.978***	0.981***	0.129	0.68
P20	-0.001	-0.439***	0.860***	1.583***	0.128	0.72
GRS Test	0.508 [0.96]					

Panel H: WN(L)

	α_A	β^{WN}	β_{erm}	β_{smb}	β_{hml}	R^2
P1	-0.003	0.719***	0.919***	1.015***	0.167	0.66
P2	-0.001	0.443***	1.004***	0.632***	0.232**	0.67
P3	0.003	0.554***	0.879***	0.910***	0.215**	0.60
P4	0.004	0.335***	0.809***	0.619***	0.112	0.61
P5	0.003	0.471***	0.819***	0.792***	0.309***	0.65
P6	-0.005	0.232***	0.790***	0.543***	0.351***	0.63
P7	-0.008	0.212**	0.787***	0.764***	0.380***	0.63
P8	-0.012***	-0.239***	0.771***	0.291***	0.642***	0.64
P9	-0.003	-0.060	0.851***	0.254***	0.406***	0.68
P10	0.004	-0.074	0.761***	0.521***	0.171*	0.63
P11	-0.003	-0.352***	0.852***	0.266***	0.480***	0.62
P12	-0.009	-0.292***	0.811***	0.547***	0.348***	0.63
P13	-0.001	-0.309***	0.840***	0.393***	0.176**	0.67
P14	0.005	-0.202**	0.888***	0.339***	0.478***	0.59
P15	-0.000	-0.503***	0.944***	0.345***	0.379***	0.65
P16	-0.001	-0.665***	0.693***	1.046***	0.258*	0.56
P17	-0.001	-0.561***	0.846***	0.688***	0.245**	0.70
P18	-0.001	-0.431***	0.895***	0.907***	0.387***	0.71
P19	0.007	-0.500***	0.854***	1.122***	0.093	0.74
P20	-0.007	-0.743***	0.893***	1.028***	-0148	0.69
GRS Test	0.961 [0.51]					

Panel I: MO(L)

	α_A	β^{MO}	β_{erm}	β_{smb}	β_{hml}	R^2
P1	-0.005	0.798***	0.679*	1.779***	-0.132	0.48
P2	-0.004	0.575***	0.858***	1.358***	-0.064	0.55
P3	-0.015*	0.479***	1.051***	0.758***	0.328**	0.46
P4	-0.005	0.359***	0.734***	0.912***	0.538***	0.48
P5	-0.005	0.063	0.880***	0.311**	0.111	0.49
P6	-0.009	0.244**	0.769***	0.589***	0.457***	0.31
P7	-0.007	-0.024	0.641***	0.979***	0.241*	0.48
P8	-0.007	-0.039	0.975***	0.639***	0.593***	0.56
P9	-0.005	-0.382***	0.792***	0.633***	0.546***	0.50
P10	-0.005	-0.236***	0.778***	0.634***	0.372***	0.50
P11	-0.011	-0.257***	0.805***	0.866***	0.475***	0.56
P12	-0.010	0.017	0.894***	0.741***	0.268	0.41
P13	-0.003	-0.224**	0.842***	0.688***	0.347**	0.47
P14	-0.012	-0.468	0.611***	0.957***	0.211	0.49
P15	-0.015	-0.564***	0.762***	0.942***	0.697***	0.53
P16	0.001	-0.462***	0.895***	1.297***	0.554**	0.60
P17	-0.004	-0.869***	0.938***	0.363	-0.046	0.50
P18	0.001	-0.670***	0.852***	0.943***	0.302	0.53
P19	-0.000	-0.703***	0.811***	1.017***	0.008	0.50
P20	-0.013	-0.611***	0.920***	1.203***	-0.125	0.52
GRS Test	0.605 [0.90]					

Table 3

Regression of Excess Returns on Global Mimicking Portfolios

Panel A: MA

	alpha	ly	erm	smb	hml	R^2
P1	-0.009	0.528***	1.036***	1.438***	0.089	0.76
P2	-0.001	0.471***	0.869***	1.186***	0.127	0.77
P3	-0.000	0.435***	0.889***	1.009***	0.146***	0.85
P4	0.001	0.381***	0.914***	1.028***	0.113	0.77
P5	-0.005	0.374***	0.905***	0.934***	0.307***	0.79
P6	-0.002	0.243***	0.850***	0.735***	0.224***	0.83
P7	-0.008***	0.263***	0.844***	0.775***	0.351***	0.85
P8	-0.008**	0.220***	0.928***	0.846***	0.403***	0.83
P9	-0.002	-0.072	0.830***	0.617***	0.323***	0.80
P10	-0.005	-0.136*	0.941***	0.568***	0.462***	0.83
P11	0.000	-0.216***	0.812***	0.744***	0.422***	0.84
P12	-0.007**	-0.025	0.912***	0.794***	0.418***	0.86
P13	-0.004	-0.042	0.902***	0.918***	0.389***	0.85
P14	-0.004	-0.429***	0.821***	0.753***	0.327***	0.83
P15	-0.006	-0.295***	0.909***	0.867***	0.379	0.87
P16	-0.005	-0.585***	0.854***	0.949***	0.385***	0.83
P17	-0.001	-0.570***	0.881***	1.021***	0.139***	0.89
P18	0.000	-0.601***	0.855***	1.002***	0.280***	0.85
P19	-0.008	-0.483***	1.008***	1.147***	0.278***	0.85
P20	-0.009	-0.934***	0.975***	1.418***	0.143	0.85
GRS Test	1.316 [0.18]					

Panel B: NE

	alpha	ly	erm	smb	hml	R^2
P1	-0.010	0.811***	1.083***	1.702***	0.082	0.67
P2	0.000	0.536***	1.030***	0.971***	0.183**	0.77
P3	0.008	0.540***	0.974***	1.242***	0.128	0.77
P4	0.002	0.369***	0.951***	1.042***	0.125	0.76
P5	-0.005	0.334***	0.926***	0.964***	0.188**	0.80
P6	-0.010**	0.083	0.899***	0.716***	0.416***	0.75
P7	-0.002	0.109	0.833***	0.700***	0.197**	0.71
P8	0.007	0.073	0.696***	0.878***	0.206**	0.62
P9	-0.004	0.075	0.772***	0.878***	0.410***	0.71
P10	-0.004	0.108	0.854***	0.851***	0.272***	0.77
P11	-0.006	-0.163*	0.850***	1.016***	0.485***	0.78
P12	-0.008*	-0.039	1.058***	0.716***	0.528***	0.78
P13	-0.002	-0.159	1.017***	0.890***	0.453***	0.77
P14	-0.003	-0.400***	1.019***	0.910***	0.482***	0.78
P15	0.0182**	-0.984***	0.823***	0.852***	-0.141	0.72
P16	0.001	-0.426***	0.956***	0.989***	0.439***	0.74
P17	-0.006	-0.405***	0.996***	1.069***	0.258***	0.79
P18	-0.013**	-0.461***	0.995***	1.067***	0.200**	0.77
P19	0.001	-0.416***	0.908***	1.495***	0.050	0.75
P20	-0.011	-0.663***	1.058***	1.459***	0.056	0.79
GRS Test	1.477 [0.10]					

Panel C: SA

	alpha	ly	erm	smb	hml	R^2
P1	-0.007	0.389*	0.947***	1.529***	0.058	0.60
P2	-0.007	0.375***	0.922***	0.738***	0.211**	0.62
P3	-0.000	0.284***	0.833***	0.939***	0.385***	0.73
P4	-0.009**	0.257***	0.867***	0.803***	0.441***	0.75
P5	-0.003	0.068	0.861***	0.614***	0.425***	0.75
P6	-0.010**	-0.177*	0.854***	0.513***	0.520***	0.75
P7	0.000	-0.166***	0.895***	0.439***	0.539***	0.78
P8	-0.012***	0.020	0.817***	0.655***	0.426***	0.79
P9	-0.001	-0.052	0.926***	0.644***	0.412***	0.74
P10	0.004	-0.102	0.773***	0.667***	0.487***	0.70
P11	-0.001	-0.243**	0.930***	0.584***	0.389***	0.75
P12	-0.009*	-0.428***	0.857***	0.689***	0.433***	0.80
P13	-0.006	-0.123	0.937***	0.774***	0.513***	0.74
P14	-0.008	-0.542***	0.824***	0.753***	0.394***	0.81
P15	-0.008	-0.316***	0.908***	0.878***	0.512***	0.81
P16	-0.000	-0.534***	1.024***	0.759***	0.429***	0.82
P17	-0.009*	-0.227**	0.951***	1.044***	0.379***	0.81
P18	0.000	-0.819***	0.893***	0.825***	0.243***	0.83
P19	-0.016**	-0.734***	0.924***	1.382***	0.301**	0.76
P20	-0.017**	-1.009***	0.966***	1.177***	0.280**	0.77
GRS Test	1.720 [0.04]					

Panel D: EN

	alpha	ly	erm	smb	hml	R^2
P1	-0.002	0.271***	0.902***	1.232***	0.272***	0.77
P2	0.001	0.461***	0.830***	1.205***	0.247***	0.76
P3	-0.006	0.246***	0.891***	0.853***	0.451***	0.81
P4	-0.007**	0.106	0.935***	0.543***	0.396***	0.80
P5	-0.006*	0.140*	0.842***	0.605***	0.362***	0.79
P6	-0.007**	-0.047	0.880***	0.471***	0.449***	0.82
P7	-0.003	-0.159**	0.778***	0.424***	0.350***	0.79
P8	-0.005*	-0.053	0.737***	0.458***	0.388***	0.78
P9	-0.006*	-0.202***	0.771***	0.419***	0.421***	0.80
P10	-0.004	-0.343***	0.807***	0.420***	0.316***	0.82
P11	-0.007**	-0.418***	0.784***	0.400***	0.336***	0.80
P12	-0.006*	-0.316***	0.817***	0.402***	0.368***	0.80
P13	-0.004	-0.489***	0.818***	0.499***	0.355***	0.85
P14	-0.003	-0.515***	0.842***	0.495***	0.452***	0.84
P15	-0.008**	-0.616***	0.878***	0.453***	0.472	0.84
P16	-0.006	-0.362***	0.977***	0.555***	0.540***	0.85
P17	-0.004	-0.562***	0.887***	0.604***	0.444***	0.83
P18	-0.006	-0.541***	0.850***	1.070***	0.341***	0.88
P19	-0.003	-0.688***	0.844***	0.918***	0.302***	0.84
P20	-0.006	-0.631***	0.987***	1.073***	0.360***	0.78
GRS Test	0.656 [0.85]					

Panel E: PA

	alpha	ly	erm	smb	hml	R^2
P1	-0.005	0.495***	1.145***	1.299***	-0.067	0.66
P2	0.001	0.223*	0.904***	1.035***	-0.034	0.70
P3	0.000	0.121	1.019***	0.808***	0.079	0.73
P4	-0.004	0.070	1.012***	0.687***	0.212**	0.71
P5	0.004	0.175*	0.907***	1.084**	0.150*	0.78
P6	-0.007	-0.054	0.901***	0.644***	0.134	0.71
P7	-0.002	0.054	0.888***	0.856***	0.239***	0.77
P8	-0.004	-0.222**	0.951***	0.852***	0.451***	0.77
P9	0.004	-0.270***	0.921***	0.767***	0.114	0.78
P10	0.003	-0.416***	0.855***	0.850***	0.139	0.72
P11	0.002	-0.421***	0.739***	1.072***	0.214*	0.65
P12	0.006	-0.656***	0.957***	0.599***	0.220**	0.79
P13	-0.004	-0.480***	1.050***	0.678***	0.360***	0.85
P14	-0.003	-0.459***	1.032***	0.849***	0.155**	0.87
P15	-0.000	-1.036***	1.008***	0.759***	0.067	0.83
P16	0.003	-0.751***	0.843***	1.043***	-0.224**	0.77
P17	-0.017***	-0.727***	1.128***	1.007***	0.432***	0.83
P18	0.009	-0.750***	0.974***	1.112***	-0.218**	0.79
P19	-0.010	-1.026***	1.041***	1.037***	-0.117	0.78
P20	0.002	-1.199***	1.075***	1.119***	-0.228	0.75
GRS Test	1.065 [0.39]					

Panel F: ES(L)

	alpha	ly	erm	smb	hml	R^2
P1	0.001	0.445***	0.831***	1.044***	0.409***	0.54
P2	0.002	0.117	0.747***	0.614***	0.644***	0.54
P3	-0.005	0.112	0.737***	0.392***	0.377***	0.62
P4	-0.003	-0.205*	0.669***	0.458***	0.291**	0.55
P5	-0.004	-0.435***	0.743***	0.302***	0.402***	0.58
P6	-0.005	-0.737***	0.895***	0.481***	0.430	0.64
P7	0.004	-0.305***	0.731***	0.651***	0.396***	0.61
P8	0.001	-0.049	0.988***	0.859***	0.428***	0.66
P9	-0.008	-0.132	1.009***	0.860***	0.564***	0.66
P10	0.017*	-0.471	0.885***	0.788***	0.606***	0.55
GRS Test	0.420 [0.99]					

Panel G: WS(L)

	alpha	ly	erm	smb	hml	R^2
P1	-0.008	0.817***	1.045***	1.324***	0.079	0.55
P2	-0.007	1.021***	1.224***	1.293***	0.427***	0.54
P3	-0.002	1.045***	1.081***	1.072***	0.372**	0.53
P4	0.001	0.898***	0.838***	1.045***	0.145	0.60
P5	0.000	0.640***	0.826***	0.812***	0.281***	0.53
P6	-0.004	0.485***	0.900***	0.587***	0.376***	0.54
P7	0.001	0.621***	0.955***	0.792***	0.467***	0.57
P8	-0.002	0.520***	0.904***	0.677***	0.363***	0.60
P9	-0.001	0.482***	0.791***	0.848***	0.441***	0.48
P10	0.005	0.329***	0.871***	0.716***	0.506***	0.61
P11	0.005	0.246**	0.874***	0.617***	0.383***	0.64
P12	0.006	-0.011	0.801***	0.844***	0.231***	0.59
P13	0.001	0.033	1.021***	0.789***	0.497***	0.69
P14	0.002	0.186	1.037***	0.792***	0.455***	0.70
P15	-0.005	-0.120	0.933***	0.746***	0.472***	0.58
P16	-0.001	-0.541***	0.968***	0.622***	0.221*	0.65
P17	0.004	-0.334**	0.850***	0.956***	0.611***	0.66
P18	0.001	-0.473***	0.827***	1.200***	0.348***	0.75
P19	-0.011	-0.748***	0.908***	0.816***	0.102	0.69
P20	-0.000	-0.421***	0.845***	1.612***	0.172	0.71
GRS Test	0.451 [0.98]					

Panel H: WN(L)

	alpha	ly	erm	smb	hml	R^2
P1	-0.008	0.674***	0.961***	0.944***	0.263**	0.62
P2	-0.004	0.434***	1.034***	0.595***	0.294***	0.66
P3	0.000	0.477***	0.906***	0.839***	0.282**	0.57
P4	0.002	0.197*	0.814***	0.543***	0.138	0.59
P5	0.000	0.411***	0.843***	0.732***	0.367***	0.62
P6	-0.006	0.356***	0.782***	0.456***	0.356***	0.61
P7	-0.009	-0.071	0.765***	0.643***	0.368***	0.62
P8	-0.011**	-0.422***	0.732***	0.241***	0.581***	0.66
P9	-0.004	-0.226***	0.826***	0.199**	0.373***	0.69
P10	0.005	-0.124	0.751***	0.508***	0.153*	0.63
P11	-0.001	-0.427***	0.820***	0.267***	0.419***	0.62
P12	-0.008	-0.325***	0.787***	0.556***	0.302***	0.63
P13	0.001	-0.416***	0.806***	0.376***	0.115	0.68
P14	0.006	-0.412***	0.848***	0.276**	0.418***	0.61
P15	0.003	-0.494***	0.912***	0.386***	0.308***	0.63
P16	0.002	0.018	0.735***	1.350***	0.266	0.51
P17	0.002	-0.473***	0.820***	0.763***	0.178	0.67
P18	-0.001	-0.305**	0.882***	0.986***	0.344***	0.69
P19	0.010	-0.536***	0.817***	1.146***	0.016	0.73
P20	-0.003	-0.884***	0.826***	1.031***	-0.275	0.69
GRS Test	1.015 [0.44]					

Panel I: MO(L)

	alpha	ly	erm	smb	hml	R^2
P1	-0.007	1.112***	0.719***	1.966***	-0.06	0.45
P2	-0.006	0.811***	0.887***	1.499***	-0.011	0.53
P3	-0.017*	0.517***	1.058***	0.773***	0.338**	0.43
P4	-0.006	0.520***	0.753***	1.008***	0.574***	0.47
P5	-0.005	0.067	0.881***	0.309**	0.110	0.48
P6	-0.009	0.222	0.769***	0.569***	0.453***	0.29
P7	-0.007	0.019	0.646***	1.009***	0.251*	0.48
P8	-0.007	0.112	0.991***	0.738***	0.625***	0.57
P9	-0.002	-0.042	0.826***	0.862***	0.618***	0.46
P10	-0.004	-0.430***	0.756***	0.514***	0.330***	0.50
P11	-0.009	-0.468***	0.781***	0.734***	0.429***	0.57
P12	-0.009	0.371*	0.932***	0.970***	0.343**	0.42
P13	-0.002	-0.304	0.832***	0.641***	0.330**	0.46
P14	-0.009	0.001	0.657***	1.272***	0.309*	0.44
P15	-0.012	-0.418*	0.773***	1.049***	0.726***	0.48
P16	0.003	-0.239	0.916***	1.452***	0.600***	0.57
P17	-0.000	-1.041***	0.913***	0.271	-0.085	0.45
P18	0.005	-0.686***	0.845***	0.948***	0.297	0.48
P19	0.005	-0.106	0.869***	1.419***	0.133	0.43
P20	-0.009	-0.148	0.962***	1.516***	-0.029	0.48
GRS Test	0.519 [0.96]					

Table 4

Cross-Sectional Tests Using Local Mimicking Portfolios

	MA	NE	SA	EN	PA	ES(L)	WS(L)	WN(L)	MO(L)
λ_{ly}	−0.715	−0.794	−0.971	−0.656	−0.847		−1.563	−1.020	−1.736
	(1.45)	(1.68)	(1.79)	(1.78)	(1.34)		(2.29)	(2.05)	(2.40)
λ_m	−1.693	−0.528	1.734	0.594	−1.224		−0.702	1.951	0.720
	(0.97)	(0.34)	(0.87)	(0.31)	(0.73)		(0.43)	(0.86)	(0.38)
λ_{smb}	0.504	0.208	−0.354	1.462	0.284		1.142	0.961	0.818
	(0.60)	(0.24)	(0.35)	(1.97)	(0.28)		(1.37)	(1.18)	(0.94)
λ_{hml}	−0.752	−1.299	−0.043	0.426	−0.489		2.588	0.000	0.938
	(0.60)	(1.30)	(0.03)	(0.24)	(0.51)		(2.28)	(0.01)	(0.97)
λ_0	3.368	3.119	0.928	0.317	3.571		1.363	−0.146	0.351
	(2.62)	(2.43)	(0.42)	(0.26)	(2.15)		(1.03)	(0.08)	(0.18)
$\overline{R}^2$	0.66	0.26	0.40	0.85	0.40		0.79	0.42	0.57
$\overline{R}^2(ff)$	0.49	0.17	0.34	0.84	0.32		0.79	0.36	0.48

Table 5

Cross-Sectional Tests Using Global Mimicking Portfolio

	MA	NE	SA	EN	PA	ES(L)	WS(L)	WN(L)	MO(L)
λ_g	−1.174	−0.492	−1.146	−1.313	−0.790		−1.058	−1.539	−1.748
	(1.85)	(0.69)	(1.86)	(2.10)	(1.30)		(1.87)	(2.14)	(2.29)
λ_m	−2.085	−0.409	2.663	0.446	−1.068		−0.729	2.055	0.720
	(1.13)	(0.26)	(1.45)	(0.23)	(0.65)		(0.45)	(0.92)	(0.42)
λ_{smb}	0.861	−0.024	0.004	1.511	0.368		1.224	1.111	1.135
	(1.10)	(0.02)	(0.00)	(2.09)	(0.41)		(1.45)	(1.37)	(1.47)
λ_{hml}	−0.013	−1.743	0.265	0.703	−0.698		2.721	0.209	1.113
	(0.15)	(1.62)	(0.15)	(0.42)	(0.73)		(2.50)	(0.18)	(1.21)
λ_0	3.005	3.151	−0.436	0.293	3.216		1.256	−0.422	0.132
	(2.44)	(2.45)	(0.26)	(0.23)	(2.20)		(0.90)	(0.22)	(0.08)
$\overline{R}^2$	0.61	0.26	0.36	0.84	0.40		0.80	0.40	0.57

Table 6

Cross-Sectional Tests Using Global and Local Mimicking Portfolios

	MA	NE	SA	EN	PA	ES(L)	WS(L)	WN(L)	MO(L)
λ_k	−0.724	−0.794	−0.978	−0.681	−0.843		−1.588	−1.000	−1.722
	(1.46)	(1.69)	(1.81)	(1.86)	(1.34)		(2.33)	(2.02)	(2.39)
λ_g	−0.372	−0.353	−0.529	0.153	−0.719		−0.855	−0.827	−1.393
	(0.36)	(0.44)	(0.68)	(0.11)	(0.79)		(1.28)	(0.70)	(1.26)
λ_m	−1.429	−0.421	1.671	2.704	−1.107		−0.438	1.983	0.528
	(0.75)	(0.27)	(0.85)	(1.05)	(0.67)		(0.26)	(0.88)	(0.29)
λ_{smb}	0.425	0.021	−0.378	1.278	0.332		1.192	0.893	0.922
	(0.47)	(0.02)	(0.38)	(1.70)	(0.33)		(1.41)	(1.16)	(1.02)
λ_{hml}	−0.903	−1.593	0.085	−1.423	−0.678		2.412	−0.126	0.976
	(0.68)	(1.40)	(0.05)	(0.62)	(0.71)		(2.16)	(0.12)	(1.00)
λ_0	3.335	3.142	0.992	−0.645	3.306		1.176	−0.054	0.471
	(2.61)	(2.46)	(0.45)	(0.46)	(1.94)		(0.83)	(0.03)	(0.26)
$\overline{R}^2$	0.67	0.27	0.40	0.88	0.42		0.81	0.43	0.59

Table 7

Cross-Sectional Tests Using Local Mimicking Portfolios and Size Portfolios

	MA	NE	SA	EN	PA	ES(L)	WS(L)	WN(L)	MO(L)
λ_k	−1.032	−0.697	−0.875	−0.546	−1.066	−0.462	−1.467	−1.065	−2.368
	(2.06)	(1.45)	(1.60)	(1.47)	(1.67)	(0.77)	(2.15)	(2.10)	(3.19)
λ_m	−5.751	−2.060	−3.246	0.526	−3.393	0.074	−1.933	−0.491	−2.415
	(4.50)	(1.73)	(2.88)	(0.27)	(2.17)	(0.04)	(1.65)	(0.39)	(1.99)
λ_{smb}	0.197	1.319	0.487	1.156	0.290	1.962	1.433	0.966	0.784
	(0.34)	(1.98)	(0.72)	(2.58)	(0.44)	(2.58)	(2.14)	(1.47)	(0.89)
λ_{hml}	−1.499	−0.697	−0.875	−0.546	1.264	−0.148	1.095	−0.193	1.766
	(1.72)	(1.45)	(1.60)	(1.47)	(1.71)	(0.11)	(1.25)	(0.26)	(2.42)
λ_0	7.205	2.635	4.214	0.145	5.272	0.805	2.473	1.821	2.470
	(6.49)	(2.44)	(4.29)	(0.16)	(4.06)	(0.52)	(2.57)	(1.82)	(2.40)
$\overline{R}^2$	0.65	0.40	0.47	0.64	0.42	0.47	0.43	0.37	0.65

Figure 1: Census Divisions