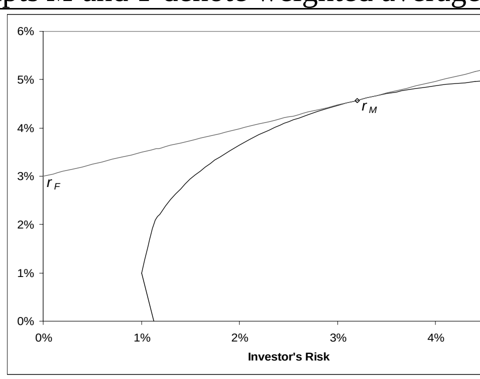
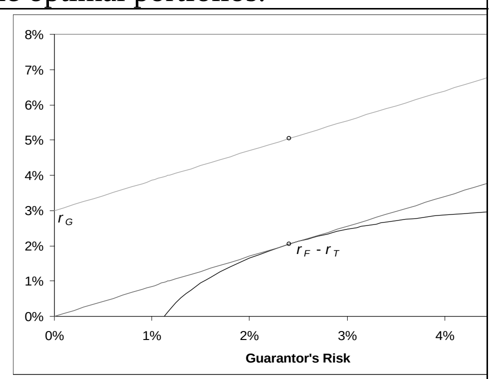
Model:	CAPM	COPM
Actors:	Investors	Guarantors
Initial wealth:	W	W, invested at return r_G
Portfolio objects, Maturity, properties:	Capital assets, one year, subject to credit risk	Capital obligations, one year, no credit risk
Weights (sum to unity):	$\omega_k, k = 1,\ldots, K$	$\omega_m, m = 1,\ldots, M$
Wealth allocation:	Fraction, ϕ	Leverage, λ
Return/growth to maturity, moments:	$\tilde{r}_k, \mathrm{E}[\tilde{r}_k] = r_k$, $Cov[r_k, r_l] = \sigma_{k,l}$	$\tilde{r}_m, \mathrm{E}[\tilde{r}_m] = r_m$, $Cov[r_m, r_n] = \sigma_{m,n}$

Note: The covariances have hidden diagonal terms inversely proportional to the monetary weights. The effects of these terms are expected to become negligible under diversification.

Final wealth:	$W\left[1 + (1-\phi) r_F + \phi \sum_{k=1}^{K} \omega_k \tilde{r}_k\right]$	$W\left[1 + r_G + \lambda \sum_{m=1}^{M} \omega_m (r_F - \tilde{r}_m)\right]$
Expected return:	$(1-\phi) r_F + \phi \sum_{k=1}^{K} \omega_k r_k$	$r_G + \lambda \sum_{m=1}^{M} \omega_m (r_F - r_m)$
Variance of return:	$\phi^2 \sum_{k,l}^{K} \sigma_{k,l} \omega_k \omega_l$	$\lambda^2 \sum_{m,n}^{M} \sigma_{m,n} \omega_m \omega_n$

The quadratic program minimizing risk at fixed return is solved the same way in both cases, giving an efficient frontier. Noting the variability of ϕ and λ, one finds the optimal solution along a tangent line through (0, r_F) for CAPM, through (0, 0) for COPM. Subscripts M and T denote weighted averages over the optimal portfolios.





Tangent to efficient frontier (maximizes return):	$R(\phi) = r_F + \phi(r_M - r_F)$, $\Sigma(\phi) = \phi \sigma_M, \phi > 0$	$R(\lambda) = \lambda(r_F - r_T)$, $\Sigma(\lambda) = \lambda \sigma_T, \lambda > 0$
Investor's/Guarantor's return:	$R_I(\phi) = r_F + \phi(r_M - r_F)$	$R_G = r_G + \lambda(r_F - r_T)$
Condition for existence of a market:	$r_M > r_F$	$r_T < r_F$
Return/Funding rate for next addition:	$r_i = r_F + \beta_i (r_M - r_F)$, $\beta_i = \sigma_{M,i} / \sigma_M^2$, $\beta_i (r_M - r_F) = risk\ premium$	$r_i = r_F - \mathrm{B}_i (r_F - r_T)$, $\mathrm{B}_i = \sigma_{T,i} / \sigma_T^2$, $\mathrm{B}_i (r_F - r_T) = MVM$