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Contagion Effects between Fine Wines and other alternative assets : a cointegration model

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Context and literature

A growing financial literature concerning wine investment has been developed in two ways

- **A static perspective** : investigated the specificities of wine and their impact on prices or returns (See, e.g., Byron and Ashenfelter (1995), Combris et al. (1997), Landon and Smith (1997), Jones and Storchmann (2001), Schamel and Anderson (2003) and Ashenfelter (2008) and **Oczkowski and Doucouliagos, 2014**)

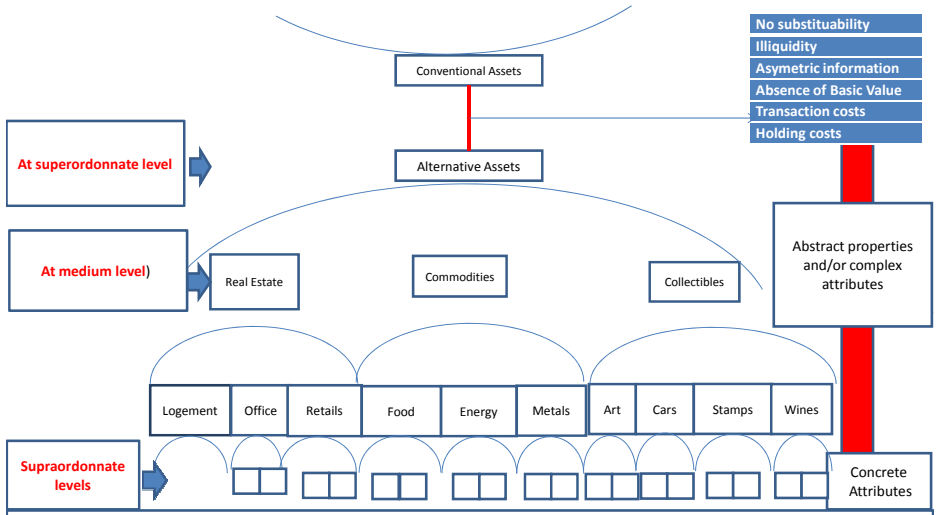
- **A dynamic perspective:** explores the impact of financial asset prices (or returns) on fine wine prices (or return) –considered as an alternative asset (See, e.g., Krasker, 1979, Jaeger, 1981, Fogarty, 2006, 2010, Masset and Weisskopf, 2010, 2015, Faye, Prat, Le Fur 2015).

However, no literature has investigated the price relation between different sorts of alternative asset classes.

-> **Definition** *(Thune K., 2014)*. : "***Alternative investments can be defined to include any investments outside of the mainstream and conventional asset types, such as stocks, bonds, cash, mutual funds***" .

Indeed alternative assets class isn't defined in literature except by **a large inventory which is generally depicted by an a priori taxinomic structure**.

-> **Definition** (*Bruner, 1957; Bailey, 1994*) : Taxinomy is defined as the choice of a rule for grouping non-identical objects deemed equivalent. It is a bi-dimensional structure

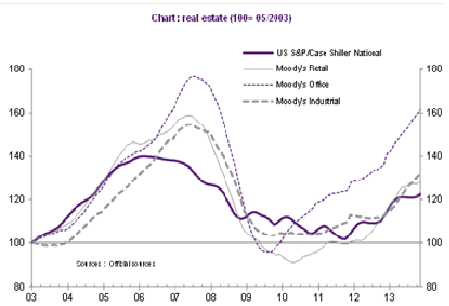


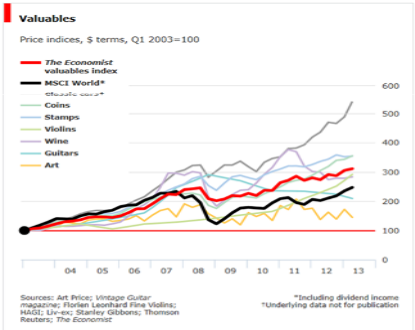
- From an economic point of view (hedonic approach), if objects share similar attributes (substituability), their price momentum should converge
- To validate this a priori taxinomy we investigate price co-movements between exemplars of collectbles, commodities and real estate

Methodological choices and data

Exemplar selection : In each category two types of exemplar have been selected according to their weight in portfolio or their price dynamism (momentum).

Categories	Weight	Price dynamism
Real estate	*Residential*	*Office property*
Commodities	*Gold*	*Gold*
Collectibles	*Art*	*Wine*





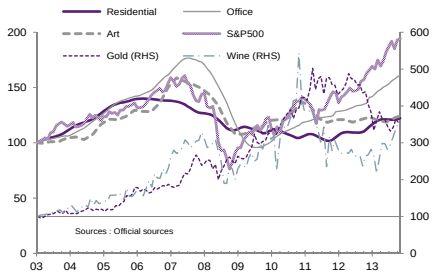
Weight of collectibles according to rich individuals' holdings (wealth-management arm of Barclays): **36% fine art**, 25% classic cars, 17% coins, 10% wine. and 6% stamps.

Methodological choices and data

Indices selection : we consider monthly price indices for the US market for the period 2003M05 and 2014M03

Categories	Products	Indices	Sources
Conventional assets	Equity	S&P 500	Datastream
Real Estate	Residential	US /CASE-SHILLER NATIONAL	Datastream
	Office	US Moody's Office	Datastream
Commodities	Precious metals	Gold	Datastream
Collectibles	Art	Artprice US index	Artprice company
	Wine	Data drawn from wineprice.com (US auction houses) $IW_t - \sum_{i=1}^{N}\left(100 * \frac{\overline{P_{it}}}{P_{i0}}\right) * \frac{n_{it}}{n_{Nt}}$	I : wine name – vintage $\overline{P_{it}}$: mean price of wine-vintage i for each t P_{i0}: mean price of wine-vintage i in t=0 n_{it}: number of bottles of i for t n_{Nt}: total of bottles for each t

Chart : Conventional and alternative assets (100=2003M05)



Methodology

Unit root tests: ADF and Phillips-Perron Unit Root Tests

	ADF		Phillips-Perron	
Series	**Level**	**First difference**	**Level**	**First difference**
Real estate Residential	-4.726417***		-2.142179	-3.277937***
Real estate Office	-3.401568**		0.844007	-2.204199**
Wine	1.269942	-15.49559***	-2.451624	-15.49559***
Art (US)	-2.356929	-2.968550***	0.514887	-3.577028***
Gold	1.910601	-13.02698***	2.162728	-13.05082***
S&P500	1.055988	-9.136478***	1.058845	-9.271655***

Notes: All series are in logs; ***, **, * denotes significant at 1%, 5% and 10%,level respectively using t-stat approach

All series are in logs. In all cases, the unit root tests have been applied using both the model with constant and the model with constant and a linear trend. The t-stats in the table are obtained with the model with constant and a linear trend for those cases in which linear trend was significant. The lag length has been selected according to the Schwartz Information Criteria.

Methodology

VAR-ECM model to explore co-movements through short and long run dynamics between conventional and alternative assets

✓ Specification

$$\Delta Y_t = \alpha_0 + \Pi \times Y_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \times \Delta Y_{t-i} + \varepsilon_t$$

With Y the vector of endogenous variables, $\Pi = \alpha \times \beta'$ where α *et* β are matrices $n \times r$ (with n being the number of variables in Y and r being the rank of Π).

- $\beta \times Y_{t-1}$ is the long-run relationship between variables (i.e. cointegrating relationships)
- α is a loading matrix giving the rate of adjustment of the variables in Y to the long-run equilibrium defined by the cointegrating relationships between endogenous variables

✓ Information criterion (AIC, LR) help to choose the optimal lag of the model (that also avoids any serial correlation in the error terms): 7 lags

✓ Johansen test: 4 cointegrating relationship

Methodology

Johansen tests

Date: 04/23/15 Time: 15:50
Sample (adjusted): 2003M12 2014M03
Included observations: 124 after adjustments
Trend assumption: Linear deterministic trend (restricted)
Series: LARTUSA LCSHILLERNAT LGOLD LOFFICE LSP LWINE
Exogenous series: LGDP100
Warning: Critical values assume no exogenous series
Lags interval (in first differences): 1 to 6

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.486531	214.9022	117.7082	0.0000
At most 1 *	0.309878	132.2481	88.80380	0.0000
At most 2 *	0.237506	86.25807	63.87610	0.0002
At most 3 *	0.218095	52.63417	42.91525	0.0041
At most 4	0.134634	22.12745	25.87211	0.1364
At most 5	0.033278	4.196652	12.51798	0.7135

Trace test indicates 4 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.486531	82.65413	44.49720	0.0000
At most 1 *	0.309878	45.99002	38.33101	0.0055
At most 2 *	0.237506	33.62389	32.11832	0.0325
At most 3 *	0.218095	30.50673	25.82321	0.0112
At most 4	0.134634	17.93079	19.38704	0.0803
At most 5	0.033278	4.196652	12.51798	0.7135

Max-eigenvalue test indicates 4 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

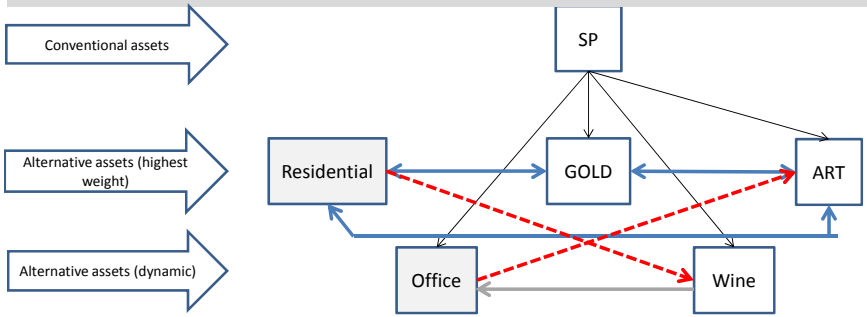
Results

Short-run causalities

Table. Short run causalities

		Residential	Office	Gold	Wine	Art (US)	S&P500
		is caused by					
Residential	*causes*	-		10,500 0,105	19,106 *0,004*	44,851 *0*	
Office			-			21,589 *0,001*	
Gold		12,541 *0,051*		-		13,082 *0,042*	
Wine			13,961 *0,030*		-		12,851 *0,046*
Art (US)		15,266 *0,018*		11,191 0,083		-	
S&P500			15,111 *0,019*	14,443 *0,025*	18,307 *0,006*	36,314 ***0,000***	-

Interpretation : Short-run co-movements



Short-run price comovements indicate :

- **A significative causality relation between conventional assets prices and all alternative assets** prices except residential real estate for which the reaction time may exceed 7months (the maximum lag in this model) according to production and transaction times
- **A significative and bi-directionnal causality between alternative assets with highest weights in portfolio**
- **A significative causality relation between the most dynamic alternative assets from wine to office,** which may be explained by a difference of liquidity and transaction time and costs between them.
- **A significative causality relation between heavy and dynamic alternative assets** through the links between Residential and Wine and the links between Office and Art. These links may come from a **wealth effect,** Real estate assets (resid and office) being the only one that can generate cash-flows. These links suggest also that **investors** in office and art (firms) are different from those that invest in residential and wine (individuals).

Results

Long-run causalities

Sample (adjusted): 2003M12 2014M03
Included observations: 124 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegration Restrictions:
B(1,1)=1,B(1,4)=0,B(1,5)=0,B(1,6)=0,B(2,1)=0,B(2,2)=1,B(2,3)=0,B(2,4)=0,B(3,1)=0,B(3,2)=0,B(3,3)=1,B(3,4)=0,B(4,...
Maximum iterations (500) reached.
Restrictions identify all cointegrating vectors
LR test for binding restrictions (rank = 4):
Chi-square(1) 0.173450
Probability 0.677064

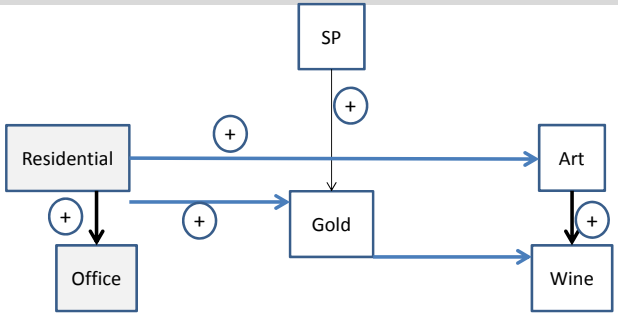
Cointegrating Eq:	CointEq1	CointEq2	CointEq3	CointEq4
LWINE(-1)	1.000000	0.000000	0.000000	0.000000
LARTUSA(-1)	4.358915 (1.11363) [3.91414]	1.000000	0.000000	0.000000
LGOLD(-1)	0.849134 (0.35635) [2.38289]	0.000000	1.000000	0.000000
LOFFICE(-1)	0.000000	0.000000	0.000000	1.000000
LCSHILLERNAT(-1)	0.000000	1.563034 (0.30206) [5.17466]	4.436777 (0.98314) [4.51286]	1.968426 (0.35178) [5.59566]
LSP(-1)	0.000000	-0.070440 (0.11292) [-0.62379]	4.373673 (0.65716) [6.65544]	0.000000
@TREND(03M05)	-0.000150 (0.00865) [-0.01737]	0.011532 (0.00207) [5.56897]	0.028699 (0.00755) [3.80187]	0.018497 (0.00236) [7.82150]
C	-31.09024	-12.72991	-49.98043	-15.54188

Results

Error Correction:	D(LWINE)	D(LARTUSA)	D(LGOLD)	D(LOFFICE)	D(LCSHILLE...	D(LSP)
CointEq1	-0.125512 (0.05751) [-2.18243]	-0.006455 (0.00320) [-2.01445]	-0.023546 (0.03356) [-0.70165]	-0.017749 (0.00341) [-5.20116]	-0.003702 (0.00171) [-2.16926]	-0.042613 (0.02116) [-2.01380]
CointEq2	0.042890 (0.44158) [0.09713]	0.035322 (0.02461) [1.43552]	0.177723 (0.25767) [0.68973]	0.128650 (0.02620) [4.90973]	-0.027592 (0.01310) [-2.10577]	-0.101298 (0.16248) [-0.62346]
CointEq3	-0.011710 (0.07240) [-0.16173]	-0.004440 (0.00403) [-1.10050]	-0.095253 (0.04225) [-2.25464]	0.015788 (0.00430) [3.67474]	-0.001838 (0.00215) [-0.85539]	-0.090003 (0.02664) [-3.37854]
CointEq4	0.129709 (0.36557) [0.35481]	-0.009980 (0.02037) [-0.48995]	-0.015330 (0.21332) [-0.07187]	-0.133723 (0.02169) [-6.16447]	0.007938 (0.01085) [0.73181]	-0.069251 (0.13451) [-0.51485]
R-squared	0.566292	0.931082	0.411345	0.936458	0.951728	0.616928
Adj. R-squared	0.349438	0.896623	0.117017	0.904686	0.927593	0.425391
Sum sq. resids	0.635785	0.001974	0.216476	0.002239	0.000560	0.086072
S.E. equation	0.088054	0.004907	0.051380	0.005225	0.002613	0.032398
F-statistic	2.611401	27.02011	1.397573	29.47503	39.43223	3.220944
Log likelihood	150.9886	509.0242	217.7861	501.2258	587.1608	274.9685
Akaike AIC	-1.757880	-7.532648	-2.835259	-7.406868	-8.792915	-3.757557
Schwarz SC	-0.802624	-6.577391	-1.880003	-6.451611	-7.837659	-2.802300
Mean dependent	0.009600	0.001660	0.009479	0.003559	0.001216	0.004602
S.D. dependent	0.109170	0.015260	0.054679	0.016924	0.009710	0.042740

Determinant resid covariance (dof adj.)	8.59E-23
Determinant resid covariance	7.19E-24
Log likelihood	2248.279
Akaike information criterion	-31.74643
Schwarz criterion	-25.37805

Interpretation : Long-run co-movements



Long-run price co-movements indicate

- A significative and positive relationship between real estate assets (from residential to office) suggests the idea of a valid group of real estate assets
- A significative and positive relationship between collectible assets (from art to wine) suggests the existence of a collectibles group
- Significative and positive relationships between **Residential** and **Art** and between **Residential** and **Wine** via the **Gold** indicate the existence of a groupe of alternative assets
- The most exogeneous variables are Residential and SP which produce cash flow suggesting that links between assets both depend on a wealth effect and a diversification effect.

Concluding remarks

Short and long-run price co-movements led us to reconsider the a-priori taxinomy.

- **Short-run** co-movements indicate a causality from conventional to alternative assets (wealth and diversification effects) and strong causalities between them, justifying the existence of this asset class
- **Long-run** co-movements seems to confirm the existence of groups of alternative assets (collectibles, real estate and commodities).
- **Causality links** seem to depend on:

- A wealth effect from those of assets which produce cash-flows to the others
- A diversification strategy of investors according to financial properties of assets (holding and transaction costs, liquidity, information…)

- The a-priori taxinomy is not suffisant to describe all possible categories of assets because it does not take into account:

- A relevant difference between highest-weight assets and dynamic assets (short-run co-movements)
- The difference between assets characterized by a basic value and those are not
- The difference between investors' types

Thank you for your attention

Any question ?

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