Investment Behaviour of Pension Funds
in Chile, Italy, Mexico and Poland

IOPS Secretariat

IOPS Technical Committee Meeting,
5 June 2018
Paris, France

www.iopsweb.org

1. Project Background

- In 2017, IOPS members decided to undertake a **quantitative analysis** on the **investment behaviour of pension funds** and their **impact** on **financial markets**
  - Previous studies seem to indicate that pension funds tend to have **counter-cyclical investment behaviour**; contributing to more stable prices in the market during substantial price changes,
  - But the existing quantitative research is **fragmented** in terms of **data coverage** and **methodology**

- This paper analyses qualitatively and quantitatively the investment behaviour of pension funds during and after the **2008-09 financial crisis** in **Chile, Mexico, Poland,** and **Italy**
  - Uses **detailed data** on **purchase** & **selling** by **asset classes,** which are valuable for investigating the pension funds' investment behaviour
  - But since only four countries were covered in the study, the **applicability of its findings** to other pension systems **may be limited**

2. Methodology

- **Four methods** were used for the analysis:
  - Analysis of **average quarterly transactions** for **four sub-periods** (pre-crisis, crisis, recovery, post-crisis) for **five asset classes** (equities, private bonds, public bonds, cash and deposits, and others)
  - **Scatter plot analysis** of the relation between **average quarterly net purchases** and **quarterly changes in asset value** (domestic equities, domestic private bond, domestic public bonds)
  - **Correlation analysis** of average quarterly transactions in **equity market** and **its index values**
  - **Regression analysis** of average quarterly transactions in **equity market** and **its index values**

3. Average quarterly transactions per sub-period

1) Equity markets

- During the 2008-09 financial crisis, pension funds in **Mexico**, **Poland** continued **buying domestic equities**, whereas **Chilean funds** were **selling**
  - With regard to **foreign equities**, **Mexican funds** became **net sellers**, while **Chilean** and **Italian funds increased** their net purchases

Jurisdiction		Pre-crisis	Crisis	Recovery	Post-crisis	Total
		Net purchases	Net purchases	Net purchases	Net purchases	Net purchases
Mexico	Domestic	-	**13.9%**	**12.4%**	3.8%	6.6%
	Foreign	-	**-3.5%**	**22.0%**	9.4%	9.5%
Chile	Domestic	7.1%	**-4.8%**	**0.6%**	1.4%	1.3%
	Foreign	1.8%	**11.3%**	**10.5%**	-2.5%	0.5%
Poland	Domestic	4.4%	**30.9%**	**49.9%**	40.9%	34.2%
	Foreign	0.8%	**0.4%**	**0.9%**	3.4%	1.7%
Italy*		11.5%	**30.6%**	**15.6%**	11.9%	16.5%

* *Unable to break down **Italian** pension funds' net purchase into of domestic and foreign equities, but majority was invested in **foreign equities***

3. Average quarterly transactions per sub-period

2) Private bond markets

- Pension funds in **Poland**, **Chile**, and **Italy remained net buyers** of **private bonds** during the periods of crisis and recovery in 2008 and 2009
  - Mexico was not included in the analysis due to incomplete data on bond investments

Jurisdiction		Pre-crisis	Crisis	Recovery	Post-crisis	Total
		Net purchases	Net purchases	Net purchases	Net purchases	Net purchases
Chile	Domestic	23.2%	**24.1%**	**13.7%**	10.1%	13.0%
	Foreign	-0.01%	**7.7%**	**42.0%**	-0.9%	4.4%
Poland	Domestic	2.8%	**4.2%**	**5.3%**	26.3%	12.6%
	Foreign	0.4%	**0.4%**	**1.1%**	-0.2%	0.3%
Italy*		10.5%	**13.5%**	**8.4%**	20.1%	15.5%

* *Unable to break down **Italian** pension funds' net purchase into of domestic and foreign private bonds, but majority was invested in **domestic private bonds***

3. Average quarterly transactions per sub-period

3) Public bond markets

- **Chilean funds**' net purchases in domestic public bonds became **sizeable during the crisis** and **afterwards**
  - **Polish funds** were **actively buying** them **before the crisis** and then **consequently lowered** their average quarterly net purchases **over time**
  - **Italian funds lowered** the percentage of net new investments **during the crisis** and **increased** them as the **economy recovered**

Jurisdiction		Pre-crisis	Crisis	Recovery	Post-crisis	Total
		Net purchases	Net purchases	Net purchases	Net purchases	Net purchases
Chile	Domestic	0.1%	**17.4%**	**22.3%**	32.4%	26.8%
	Foreign	0.4%	**2.3%**	**1.7%**	3.6%	2.9%
Poland	Domestic	91.3%	**64.3%**	**43.1%**	29.5%	51.1%
	Foreign	0.3%	**-0.1%**	**-0.3%**	0.1%	-0.0%
Italy*		68.0%	**53.4%**	**69.0%**	67.1%	64.7%

* *Unable to break down **Italian** pension funds' net purchase into of domestic and foreign public bonds, but majority was invested in **domestic public bonds***

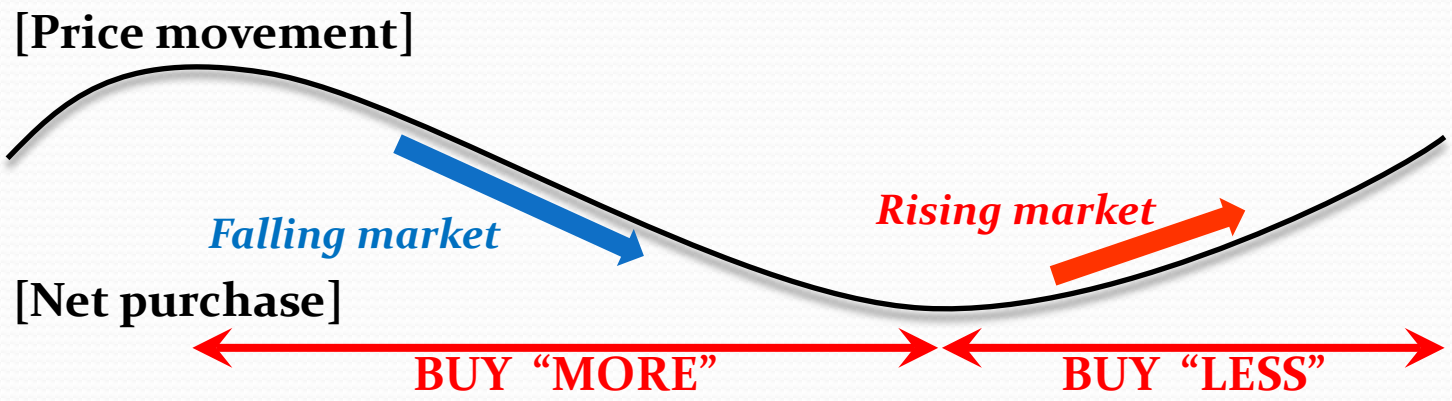
4. Scatter plot analysis

1) Defining "pro-cyclicality" and "counter-cyclicality"

- Two approaches are considered to analyse pension funds' investment behaviour
- As an example, pension funds are **counter-cyclical** in the **following cases**:

Approach 1

Approach 2



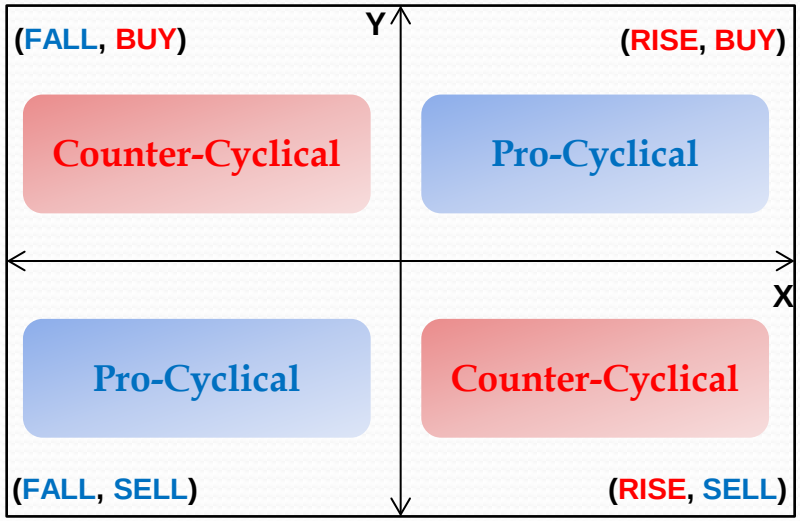
4. Scatter plot analysis

2) Interpretation of scatter plot analysis

- Comparing “price movement” and “net purchases” of assets (i.e. equities, private bonds, public bonds) by plotting quarterly data into four quadrants
- Interpretation should differ by the approaches demonstrated in the previous slide

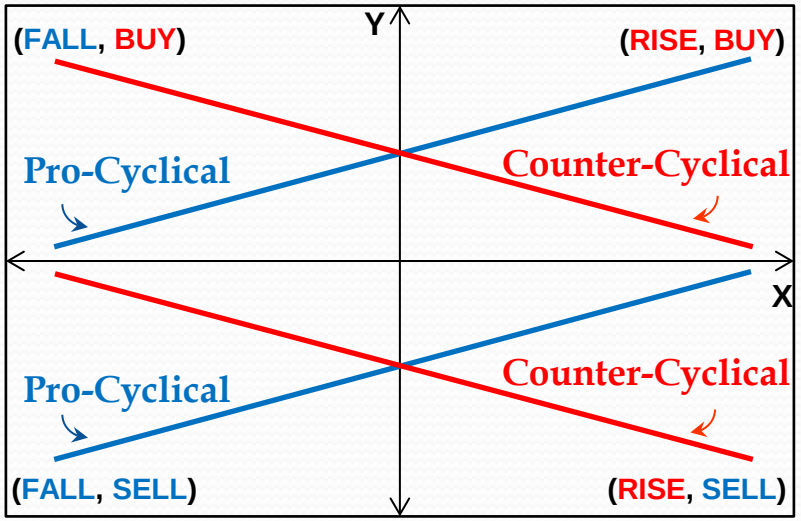
Approach 1
(directions of transaction vs. direction of price movement)

X : price movement of equity
Y : net purchases of equity



Approach 2
(change in relative size of transaction vs. direction of price movement)

X : price movement of equity
Y : net purchases of equity



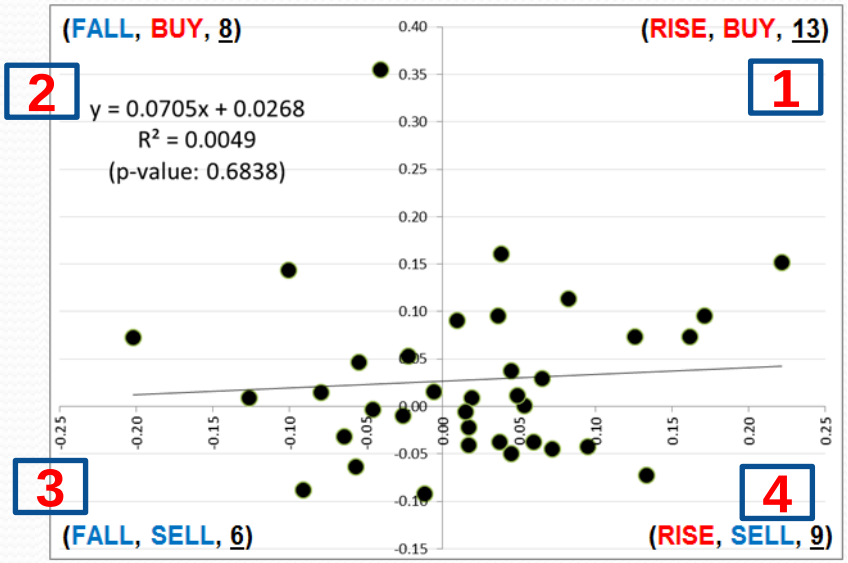
4. Scatter plot analysis

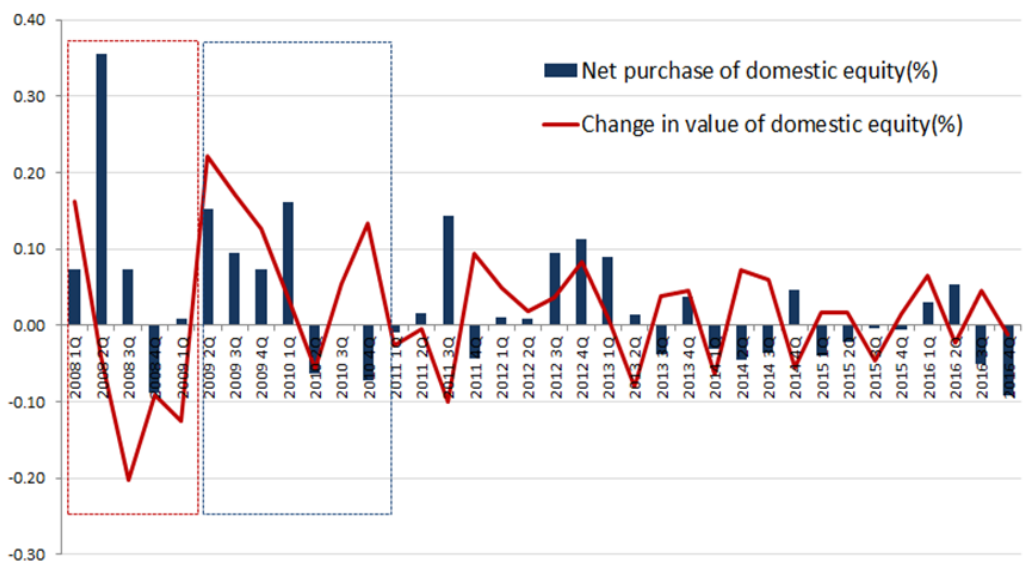
3) Results - Mexico

- Data points are spread over all quadrants, with a weak and statistically insignificant positive trend line (+0.0705x, p-value: 0.6838)
- Mexican pension funds' investments in equity seem to be influenced by other factors such as institutional framework as funds reduced net purchase in equity recently regardless of local stock price movements

X : Change in value of domestic equity (%)

Y : Net purchase of domestic equity (%)





** Imputed change in value of equities was used as a proxy of price movements*

*** Net purchases of equity and absolute changes in equity value were transformed to relative figures to obtain standardised results*

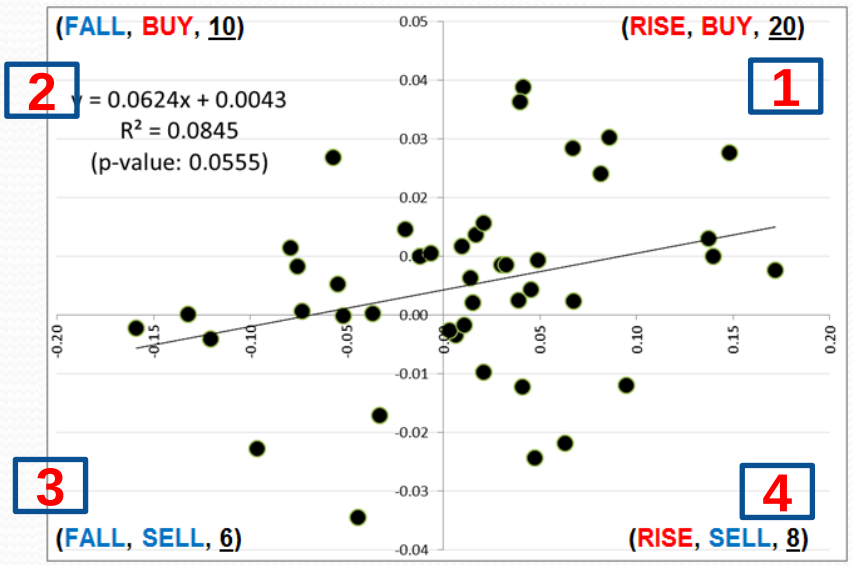
4. Scatter plot analysis

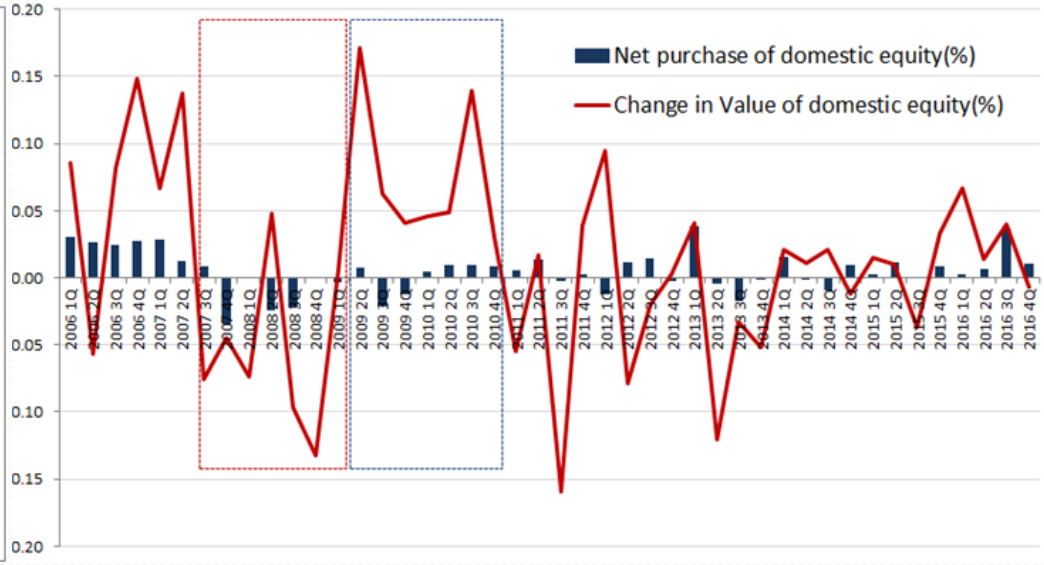
3) Results - Chile

- The majority (45% or 20 quarters) of data points are concentrated in 1st quadrant which means funds were **buying equities when equity prices were rising**
- Quite a clear positive trend line **statistically significant** but only at **10% level** (+0.0624x, p-value: 0.0555), which suggests a **pro-cyclicality** according to the description explained in the previous slide (similar result in foreign market as well)

X : Change in value of domestic equity (%)

Y : Net purchase of domestic equity (%)





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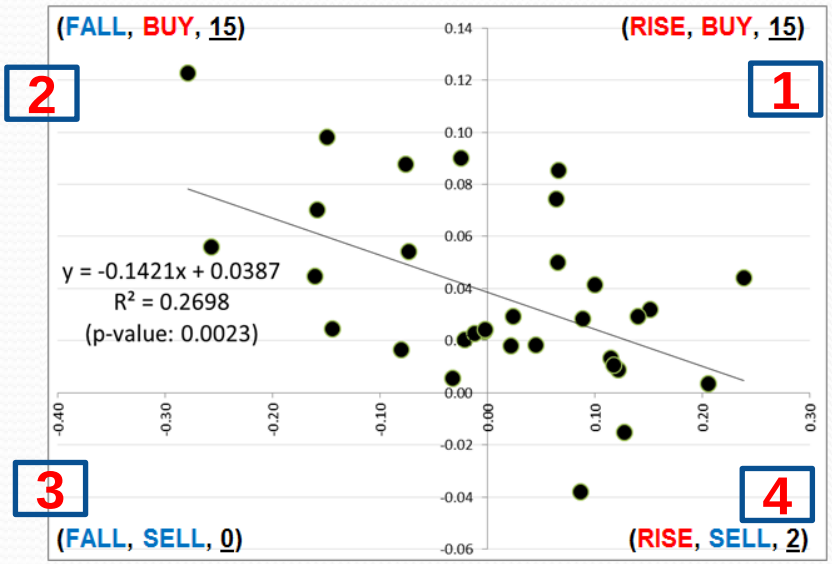
4. Scatter plot analysis

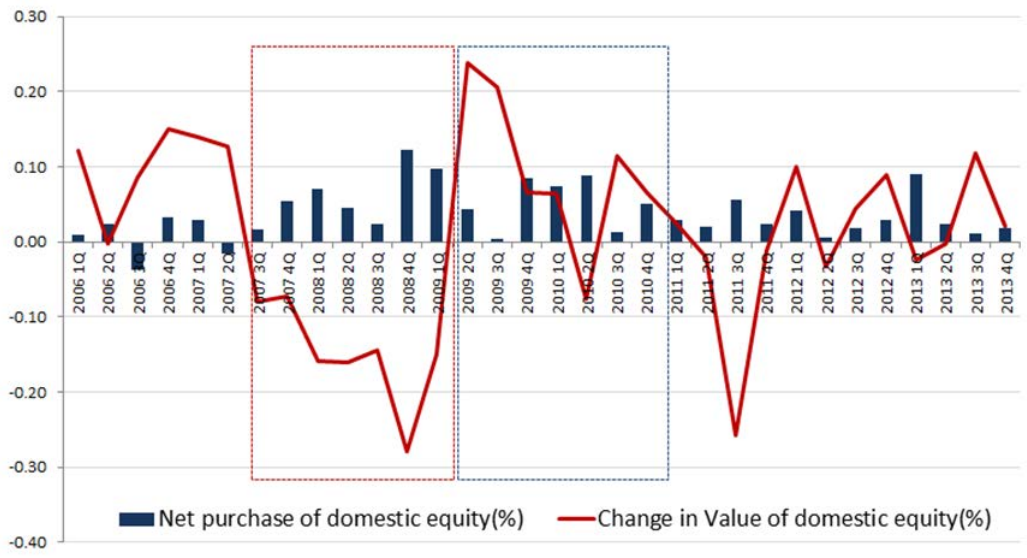
3) Results - Poland

- Data points are more concentrated in the 1st and 4th quadrants (for 30 out of 32 observations) which mean that funds were **net buyers most of the time**
- **Stronger negative** and **statistically significant trend line** (-0.1421x, p-value: 0.0023) which suggests that funds lowered their propensity for net purchases when equity prices were rising, which is a sign of **counter-cyclicality**

X : Change in value of domestic equity (%)

Y : Net purchase of domestic equity (%)





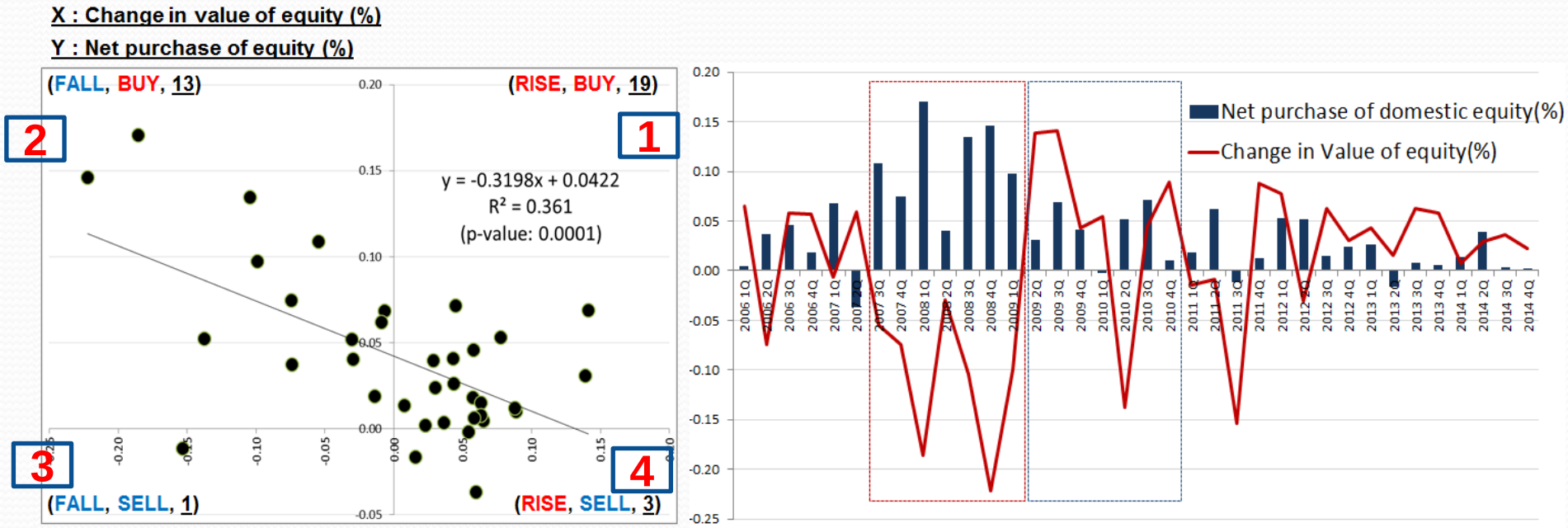
** Imputed change in value of equities was used as a proxy of price movements*

*** Net purchases of equity and absolute changes in equity value were transformed to relative figures to obtain standardised results*

4. Scatter plot analysis

3) Results - Italy

- The results for Italy are very similar to Poland
- Data points are mostly concentrated in 1st and 4th quadrants (32 out of 36) and reveal a **strong, statistically significant, negative trend line** (-0.3198x, p-value: 0.0001) , which is a sign of **counter-cyclicality**



** Imputed change in value of equities was used as a proxy of price movements*

*** Net purchases of equity and absolute changes in equity value were transformed to relative figures to obtain standardised results*

5. Correlation analysis

- Correlations between "**domestic stock market returns**" and "**net purchases of domestic equity**" (MSCI world index & net purchase of total equity for Italy)
  - Pension funds in **Poland** and **Italy** revealed a **counter-cyclical behaviour** during the whole horizon

Jurisdiction	Overall		Pre-crisis		Crisis		Recovery		Post-crisis	
	Coefficients	*P-value*	Coefficients	*P-value*	Coefficients	*P-value*	Coefficients	*P-value*	Coefficients	*P-value*
Mexico	2.1%	*0.9021*	N/A	*N/A*	26.2%	*0.6708*	21.3%	*0.6458*	-8.9%	*0.6791*
Chile	*22.9%*	*0.1356*	*-6.1%*	*0.9080*	*-14.2%*	*0.7608*	*20.6%*	*0.6578*	*10.0%*	*0.6432*
Poland	*-43.6%*	***0.0125***	*5.3%*	*0.9204*	*-70.1%*	*0.0793*	*-90.5%*	***0.0051***	*-40.8%*	*0.1875*
Italy	*-42.8%*	***0.0091***	*-33.7%*	*0.5134*	*-74.7%*	*0.0537*	*-52.6%*	*0.2255*	*20.5%*	*0.4456*

6. Regression analysis

- Single regression model where the "**stock index returns**" is the only explanatory variable of "**net purchases of domestic equity**" (MSCI world index & net purchase of total equity for Italy)
  - The results signal a **counter-cyclical behaviour** for **Poland** and **Italy**
  - In case of **Chile**, one may speculate that the funds acted **pro-cyclically**; however this finding is statistically insignificant at 10% level (**stronger evidence** of **pro-cyclicality** in case of **foreign equity market**)

Explanatory variables	Mexico	Poland	Chile	Italy
	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)
Intercept	-0.0039 (0.9831)	0.0671 (0.7463)	-0.0549 (0.7564)	0.0974 (0.5475)
Stock index returns	0.2474 (0.8822)	**-3.5341*** (0.0009)	2.6585 (0.1027)	**-5.5670*** (0.0222)
R-squared	0.0005	0.1904	0.0522	**0.1835**
#observations	36	32	44	36

7. Summary of four methods

- Clear evidence showing **Polish pension funds' counter-cyclical investment behaviour** in domestic equity market
- Some weak evidence showing that **Chilean funds** may have acted **pro-cyclically** in domestic equity market

Summary – investment behaviour with regards to domestic equities

Jurisdiction / Method	Transaction analysis (crisis)	Scatter plot analysis (whole period)	Correlation analysis (whole period)	Single regression analysis (whole period)
Mexico	continue buying counter-cyclical	?	?	?
Poland	continue buying counter-cyclical	negative trend line counter-cyclical	negative sign counter-cyclical	negative sign counter-cyclical
Chile	sell pro-cyclical	weak positive trend line (at 9%) pro-cyclical (?)	weak positive sign (at 6%) pro-cyclical (?)	weak positive sign (at 7%) pro-cyclical (?)
Italy	not applicable	not applicable	not applicable	not applicable

?: findings not statistically significant (more than 5%)

7. Summary of four methods – cont.

- Clear evidence showing **Italian pension funds' counter-cyclical investment behaviour** in foreign equity market
- **Chilean pension funds** tended to act **pro-cyclical** in foreign equity market according to **three methods** and counter-cyclically according to analysis of quarterly average transactions during the crisis

Summary – investment behaviour with regards to foreign equities

Jurisdiction / Method	Transaction analysis (crisis)	Scatter plot analysis	Correlation analysis	Single regression analysis
		(whole period)		
Mexico	sell pro-cyclical	?	?	?
Poland	continue buying counter-cyclical (negligible amounts)	?	?	?
Chile	continue buying counter-cyclical	positive trend line pro-cyclical	positive sign pro-cyclical	positive sign pro-cyclical
Italy	continue buying counter-cyclical	negative trend line counter-cyclical	negative sign counter-cyclical	negative sign counter-cyclical

?: findings not statistically significant (more than 5%)

8. Institutional determinants

- Investment behaviour by pension funds might be **influenced** not only by their strategic decisions but also by other factors that are related to the **institutional framework** they operate
  - **Italian** and **Polish pension** funds were influenced in their decisions by the **presence of strategic asset allocation benchmarks**

- From the perspective of **stability of financial markets** and **individual pension fund members**, it may seem desirable that some **strategic asset allocation benchmarks** are **set up** in the pension system and requirements for managing tracking errors are imposed
  - These should prevent pension fund managers from assuming too much investment risk that occurs when deviating too far from the long-term investment policy when not reacting to continued and substantial asset changes

Thank you!