# Report on Bachelor / Master Thesis

**Institute of Economic Studies, Faculty of Social Sciences, Charles University in Prague**

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| **Student:** | **Oldřich Koza** |
| **Advisor:** | **Jakub Matějů** |
| **Title of the thesis:** | **Stock Price Bubbles: Identification and the Effects of Monetary Policy** |

***OVERALL ASSESSMENT*** *(provided in English, Czech, or Slovak):*

This thesis estimates the bubble component in the price of the S&P index over last 143 years (using Robert Shiller's dataset on dividends), and analyses the effects of monetary policy on the behavior of the bubble. One of the most interesting conclusions is that short term money market interest rates do not significantly influence the bubble, while they do affect the fundamental component of stock prices in the short run. On the other hand, quantitative easing (measured by the size of Federal Reserve balance sheet) does inflate the bubble in the medium run, while it does not affect the fundamental. Another valuable result suggests that after fluctuating around fundamentals for more than 100 years, in the late 90s the stock prices departed from whatever could be explained by fundamentals. Even after collapses in 2001 and 2008, the "bubble" gap does not appear to be closed.

Overall, I believe Oldřich Koza did an extremely interesting and valuable piece of work which outperforms the standards of diploma theses. As far as I know, during the research on this thesis he became the most advanced expert on identifying and estimating stock price bubbles among czech economists. I strongly suggest publishing the results of this work in an international academic journal. The following discussion is meant to raise several points, adressing which may help polishing the work for potential publication.

The thesis identifies bubble component based on the Wu's procedure, which is derived from the basic asset pricing principles. The theoretical foundation of the bubble in this approach relies on the classical Tirole's easing of the transversality condition. It uses Kalman filter to distinguish the variation in the fundamental component (present value of the expected future dividened stream) of stock prices from their bubble component. A clear value added is that every step in the computation is carefully explained, rather than relying on reference papers. Also, the model is rewritten such that the dividend-price timing conforms with the standards of finance literature, which shows author's firm grasp of the model.

However, the main issue seems to be the estimated parameter $\rho>1$, which is at odds with the underlying theoretical model. Although empirically it seems reasonable that bubble exhibits autoregressive rather than explosive process (which seems to be driving this parameter estimate), the theory suggests that the bubble should be explosive in expectation. Taken the model to the extreme, $\rho>1$ would suggest an analogy of negative interest rate, discount factor above one, and negative dependence of prices on expected dividends. This problem has been encountered before by other researchers. One of the possible solutions may be to restrict parameters to theoretically plausible intervals. The other is not to take the underlying model too seriously and accept what the data tells us. Maybe a formal T-test of hypothesis that $\rho=1$ could help to evaluate how big is the issue, and taking into account the measurement error of the bubble process may easily make the difference insignificant. Either way, the principal results noted above would not be affected too much, as the main points are driven by the

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mutual behavior of price and dividend series which have clearly diverged during last two decades.

The analysis of the interaction between monetary policy and (carefully estimated) stock price bubbles is the main value added of the thesis, and to the best of my knowledge has not been done before on this scale. The main results are reasonable: short term monetary policy interest rates affect (albeit only in the short run) rather fundamental than bubble component of the price, as lower interest payments improves cash-flow of firms and allows them to pay higher dividends, which increases the fundamental price. The results confirm and quantify this effect. On the other hand, quantitative easing in the medium term fuels the bubble rather than affecting the fundamental price, as it contributes to creating free speculative capital which searches for yield and which seemed to be the main factor behind historical bubble periods.

Interestingly, the impulse response analysis also suggests that the Federal reserve does not distinguish whether an asset price boom is based on bubble or fundamental growth, as it reacts similarly to both cases. The analysis could be possibly improved by checking if the response functions do change if an alternative identification scheme is used, notably a combination of short run and sign restrictions on VAR shocks, rather than relying solely on recursive (Choleski) identification.

However, overall I believe that the thesis is an extraordinary piece of work outperforming diploma theses standards, and suggest that the committee considers granting a special award such as the Dean's prize.

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***SUMMARY OF POINTS AWARDED*** *(for details, see below):*

| **CATEGORY** | | **POINTS** |
|---|---|---|
| *Literature* | *(max. 20 points)* | 18 |
| *Methods* | *(max. 30 points)* | 29 |
| *Contribution* | *(max. 30 points)* | 29 |
| *Manuscript Form* | *(max. 20 points)* | 18 |
| **TOTAL POINTS** | *(max. 100 points)* | **94** |
| **GRADE** | **(1 – 2 – 3 – 4)** | **1** |

***NAME OF THE REFEREE: Jakub Matějů***

***DATE OF EVALUATION:***

_______________________________
***Referee Signature***

***EXPLANATION OF CATEGORIES AND SCALE:***

***LITERATURE REVIEW:*** *The thesis demonstrates author's full understanding and command of recent literature. The author quotes relevant literature in a proper way.*

| *Strong* | *Average* | *Weak* |
|---|---|---|
| *20* | *10* | *0* |

***METHODS:*** *The tools used are relevant to the research question being investigated, and adequate to the author's level of studies. The thesis topic is comprehensively analyzed.*

| *Strong* | *Average* | *Weak* |
|---|---|---|
| *30* | *15* | *0* |

***CONTRIBUTION:*** *The author presents original ideas on the topic demonstrating critical thinking and ability to draw conclusions based on the knowledge of relevant theory and empirics. There is a distinct value added of the thesis.*

| *Strong* | *Average* | *Weak* |
|---|---|---|
| *30* | *15* | *0* |

***MANUSCRIPT FORM:*** *The thesis is well structured. The student uses appropriate language and style, including academic format for graphs and tables. The text effectively refers to graphs and tables and disposes with a complete bibliography.*

| *Strong* | *Average* | *Weak* |
|---|---|---|
| *20* | *10* | *0* |

***Overall grading:***

| TOTAL POINTS | **GRADE** | | |
|---|---|---|---|
| 81 – 100 | **1** | = excellent | = výborně |
| 61 – 80 | **2** | = good | = velmi dobře |
| 41 – 60 | **3** | = satisfactory | = dobře |
| 0 – 40 | **4** | = fail | = nedoporučuji k obhajobě |