Course: EC2408
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Inflationary Tendencies of Increases in M1

An analysis of the relationship between inflation and money supply in Sweden

Introduction: In the face of economic adversity

As of writing this paper the American Congress is dealing with another debt crisis where the Joe Biden Administrationis negotiating with the speaker of the House of Represenatatives Kevin Mc- Carthy about raising the national debt ceiling of $31.4T in order to not default on its current debt. In reality, the United States hit its debt ceiling already, in January this year, but have been able to move assets and provide enough liquidity to not default. However, the method of shuffling existing resources is not sustainable in the long run and if the administration and the Republicans do not strike a deal by next week we will find ourselves in a financial crisis making the economic impact of theCorona-pandemic seem like a breeze in comparison.

When the Standard & Poors 500 indice dove 35.92% in 32 business days Fed had no choice but to react, and the response involved implementing quantitative easing and balance sheet operations, which effectively expanded the money supply 5 times over the following twelve months.

In Sweden, the monetary policy of the Riksbank have not been as expansive as the policy of Fed. However, Corona naturally had an immense impact and an expansive monetary policy was also here unevitable. Some of the monetary policies here included loans of 500BSEK to swedish banks, purchasing of securities of up to 300BSEK and in addition to that offering of loans in USD.2 Despite the relatively moderate monetary policies implemented by the Riksbank, there was a notable increase in the money supply. This occurred during the period of persistently low interest rates that prevailed during 2020. Commercial banks found it advantageous to borrow from the Riksbank to effectively utilize the fractional reserve banking system, which in turn had an impact on the M1 money supply.

This paper aims to examine the conventional economic dogma that asserts a positive relationship between the money supply and inflationary pressure. To accomplish this, vector autoregressive models and impulse response functions will be employed for analysis.

Data

We have in the study selected monthly data from Statistics Swedens ”Statistikdatabasen” for money supply measured in M1 and the annual change in consumer price index (i.e. inflation). The data span is limited to between January 2004 to November 2022, giving us 232 observations. The chosen time limitation is not arbitrary but is based on the available data. In this case, the first observation for the M1 variable is in January 2004, while the last observation for both our variables is in April 2023, as obtained from Statistics Sweden's ”Statistikdatabas.” By using this time range, the aim is to include as much of the variance in the dataset as possible, considering the available data points.

Empirical Methodology and Obtained Results

Exploring Stationarity and Cointegration: Analyzing Time Series Properties

Rationale for Incorporation of a Trend Model. Before constructing our model, we need to evaluate what type of model we are going to use throughout our analysis. I am here going to argue that in the context of inflation and money supply both variables have a deterministic trend component, this due to two factors. Firstly inflation is not considered a stochastic process since changes in other economic variables such as changes in monetary policy, supply and demand dynamics, and the fiscal policies have an impact on the change in prices. Secondly, since M1 represents the most liquid form of money, this money will reasonably be highly influenced by the Riksbanks monetary policy, fiscal policy and the underlying economic condition.[1] Therefore, I argue that this variable should not be considered stochastic.[2]

Augmented Dickey Fuller test. The first test which we need to subject our model to is the ADF test. Here we test the null (H_0) of a prevalent unit root. This test is a one-sided test conducted on the negative side. We will be focusing on the τ_3 statistics due to the incorporation of a coefficient and trend in accordance with the argument in the paragraph above. The conclusion from this test is that we are from now on dealing with two models integrated of the first order ($I(1)$).[3]

Cointegration. Due to us now dealing with two models integrated of the first order we need to test whether there exists any long-term equilibrium relationship between inflation and M1. More specifically, we need to construct a linear combination of our integrated variables and perform an Engle-Granger test which is a test where we regress our error correction term on its lagged values and lagged differences. I am here going to argue for using money supply as the dependent variable in our linear regression as money supply in conformity with traditional economics would be a driving cause of inflation (if M1 outpaces economic growth). The second step in our EG-ADF test is the ADF test itself. The outcome of the EG-ADF test, when looking at τ_2 (intercept, no trend) is that we find a value of -1.57 which implies that we can not reject the null of no cointegration when comparing it to the critical

[1] This is not to say that other types of money beside Fiat Money would be less influenced. Nevertheless, it is stating that M1 is highly impacted but the mentioned policy and conditions.

[2] We can also see that our variables, particularly M1, does exhibit a pattern of trend when looking at the decomposition of the timeseries (figure 1.1 and 1.2), advancing the proposition of using a model with trend.

[3] See Table 1.1 & 1.2.

value for the EG-ADF test of -3.41.[4] Therefore, based on our dataset, Engle-Granger ADF test does not appear to provide sufficient evidence of cointegration between M1 and inflation.

Model Selection and VAR Modeling: Finding the Best Fit

Selecting an appropriate lag order for our model. When choosing an appropriate lag for our VAR model, we will be using Akaikes Information Criteria (AIC), primarily due to its widely accepted use in econometrics. Using AIC allows for easier replication and comparison of results across studies since researchers can use the same criterion to select the lag order in VAR models. In our case, based on the evaluation using AIC, we have determined that the appropriate lag order for our VAR model with inflation and M1 is 3. Therefore, we will proceed with this lag order for our analysis.

Diagnostic testing of the VAR model.

Assessing Model Validity: Diagnostic Testing for VAR Analysis

Residual Analysis is performed using the *autocorrelation function* and *Ljung-Box test*.The autocorrelation function shows us a strong autocorrelation in as well inflation as in M1 supply. The autocorrelation in inflation, in contrast, exhibits a considerably more rapid decrease compared to the autocorrelation in M1. A significant autocorrelation in inflation is exhibited for approximately one year, where as the autocorrelation in M1 is shown to last much longer, approximately 5 years.[5] When performing a Ljung-Box test we can confirm that the model does exhibit autocorrelation with a p-value of 1.182e-04, which is noticeably below our significance level used throughout this analysis of 5%.

Model Fit and Assumptions must be confirmed using a Jarque-Bera test. Here we examine whether the model is exercising a normal distribution ($H_0 : JB = 0$), or if we can see that our variables are exercising a distribution which is not normally distributed.

[4] For full table of critical values for EG-ADF statistic: Stock, James & Watson Mark (2019). Introduction to Econometrics, p. 665.
[5] Figure not in included.

Decomposition of Inflation and Money Supply

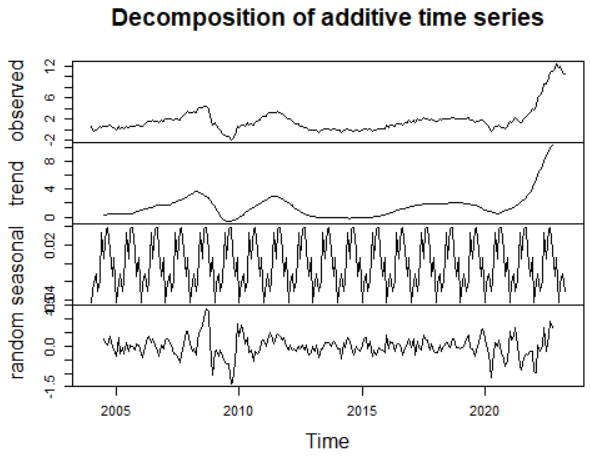

Figure 1.1: Decomposition of Inflation

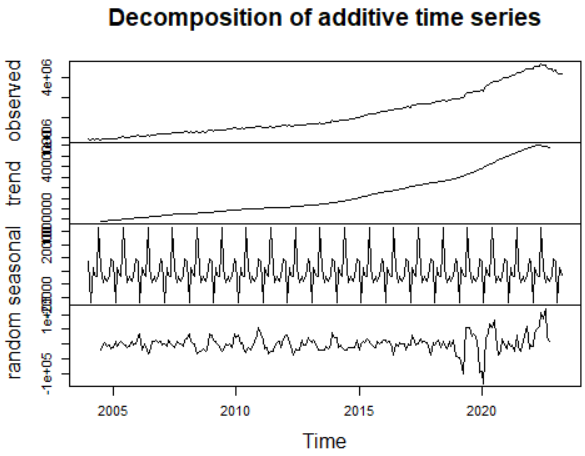

Figure 1.2: Decomposition of M1

Augmented Dickey Fuller: testing for stationarity

Test Statistic	$I(0)$	$I(1)$	1pct	5pct	10pct
τ_3	-1.56	-6.09	-3.99	-3.43	-3.13
ϕ_3	1.81	18.57	8.43	6.49	5.47
τ_2	-1.15	-5.97	-3.46	-2.88	-2.57
ϕ_1	1.04	17.84	6.52	4.63	3.81
τ_1	-0.41	-5.93	-2.58	-1.95	-1.62

Table 1.1: Augmented Dickey Fuller CPI

Test Statistic	$I(0)$	$I(1)$	1pct	5pct	10pct
τ_3	-1.60	-5.61	-3.99	-3.43	-3.13
ϕ_3	1.78	15.94	8.43	6.49	5.47
τ_2	0.41	-5.56	-3.46	-2.88	-2.57
ϕ_1	4.28	15.48	6.52	4.63	3.81
τ_1	2.67	-4.68	-2.58	-1.95	-1.62

Table 1.2: Augmented Dickey Fuller M1