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Research Report

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BoF Economics Review, No. 2/2017

Provided in Cooperation with:

Bank of Finland, Helsinki

Suggested Citation: Kortelainen, Mika (2017) : Neo-Fisherian monetary policy, BoF Economics Review, No. 2/2017, Bank of Finland, Helsinki,
<https://nbn-resolving.de/urn:nbn:fi:bof-201708011448>

This Version is available at:

<https://hdl.handle.net/10419/212987>

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Neo-Fisherian Monetary Policy

Mika Kortelainen

Abstract

According to the Neo-Fisherian Hypothesis a nominal policy rate increase leads to an increase in the rate of inflation also in the short-run and the effects of Neo-Fisherian forward guidance on inflation and output are small. These results are obtained by assuming that the nominal interest rate is unresponsive to the output gap and inflation at least temporarily and that an arbitrary assumption that a backward stable perfect foresight solution is selected among a continuum of perfect foresight equilibria is valid. The result that nominal policy rates can move inflation in the same direction is at odds with monetary theory and practice.

JEL codes: E47, E52, E61

Keywords: Neo-Fisherian Hypothesis, Monetary Policy, Liquidity

Footnote

I am indebted to Seppo Honkapohja, Juha Tarkka and Jouko Vilmunen for helpful comments on earlier drafts of the paper. The responsibility of any errors is mine alone. The views expressed in this paper are solely the responsibility of the author and should not be interpreted as reflecting the views of the Bank of Finland or the European System of Central Banks.

BoF Economics Review consists of analytical studies on monetary policy, financial markets and macroeconomic developments. Articles are published in Finnish, Swedish or English. Previous knowledge of the topic may be required from the reader.

Editors: Juha Kilponen, Jouko Vilmunen and Juuso Vanhala

1. Introduction

In classical monetary economics monetary policy affects the real economy via the liquidity effect: monetary policy is transmitted to the economy by changes in the real interest rate. This transmission channel is also called the Keynesian interest rate channel. Monetary analysis of the IS-LM model is based on this channel. This is also the basis of monetary policy transmission in the New Keynesian model.

In the New Keynesian model the interest rate channel works as follows. The central bank increases the policy rate which leads to an increase in nominal long-term rates according to the expectation theory of interest rates. The New Keynesian model assumes also price rigidities which curb the increase in inflation leading to higher real interest rates. This increase in the real interest rates increases the user cost of capital of businesses and loan expenses of households leading to a lower buildup of fixed capital and diminished demand for durable goods. Therefore the increase in the real interest rate lowers aggregate demand.

The unique equilibrium of the New Keynesian model hinges on the Taylor-principle, which states that the central bank shifts policy rates over compensating the inflation deviations from the target. In the background there is also an implicit assumption that fiscal policy does not constrain the central bank's ability to control the price equilibrium. In this sense fiscal policy is coordinated with monetary policy.

Neo-Fisherian analysis abandons an interest rate rule and assumes that the interest rate changes exogenously. Friedman (1968) argued that in such a case inflation dynamics would be explosive. However, a New Keynesian model can be solved with a constant interest rate but then there is no unique equilibrium but rather a continuum of perfect foresight equilibria which converge to a constant inflation steady-state pinned down by the nominal interest rate target and the Fisher equation. Neo-Fisherian analysis picks backward stable equilibrium whereby the initial state is consistent with the perfect foresight solution.

Neo-Fisherian analysis produces two central results. First, the central bank can by lowering (increasing) nominal interest rates decelerate (accelerate) inflation also in the short run. Second, the power of forward guidance is fairly weak. In modern New Keynesian models under rational expectations, where the equilibrium rests on Taylor-principle the power of forward guidance is very strong.

The critique of the Neo-Fisherian analysis concentrates on the assumption of backward stable equilibrium, which is seen as rather ad hoc. The result of the Neo-Fisherian analysis whereby the central bank can steer inflation to the same direction as policy rates is in conflict what the economic profession has learned in the last 200 years and based on this collective meta-analysis this result seems less credible. The second result that forward guidance may be weaker than thought in the plain vanilla New Keynesian model seems reasonable but then again the forward guidance puzzle may tell us more about how strong the assumption of rational expectations is.

In the next section we look closer at the Neo-Fisherian solution method of the new Keynesian model. The central results on interest rate changes are in section 3 and on the forward guidance in section 4. In section 5 we will go through some critique of Neo-Fisherian analysis and draw some conclusions.

2. Neo-Fisherian Hypothesis

Cochrane (2016) and Werning (2012) assume a new Keynesian model in continuous time:

$$\text{DIS} \quad \frac{dy_t}{dt} = \sigma(i_t - r_t - \pi_t)$$

$$\text{Phillips curve} \quad \frac{d\pi_t}{dt} = \rho\pi_t - \kappa y_t$$

Assuming that the economy suffers from a temporarily negative natural rate $r_t = -r$,

which lasts until time T , then the zero bound $i_t = 0$ is binding for $t < T$. The model solution for inflation and output can be written as follows, see Appendix for details.

$$\pi_t = C e^{\lambda^b t} + \frac{\kappa\sigma}{\lambda^f - \lambda^b} \left[\int_{s=-\infty}^t e^{\lambda^b(t-s)} i r_s ds + \int_{s=t}^{\infty} e^{-\lambda^f(s-t)} i r_s ds \right],$$

$$\kappa \cdot y_t = \lambda^f C e^{\lambda^b t} + \frac{\kappa\sigma}{\lambda^f - \lambda^b} \left[\lambda^f \int_{s=-\infty}^t e^{\lambda^b(t-s)} i r_s ds + \lambda^b \int_{s=t}^{\infty} e^{-\lambda^f(s-t)} i r_s ds \right]$$

where C is the integration constant and $i r_t = i_t - r_t = \begin{cases} i r, & t < T \\ 0, & t \geq T \end{cases}$ is the forcing variable.

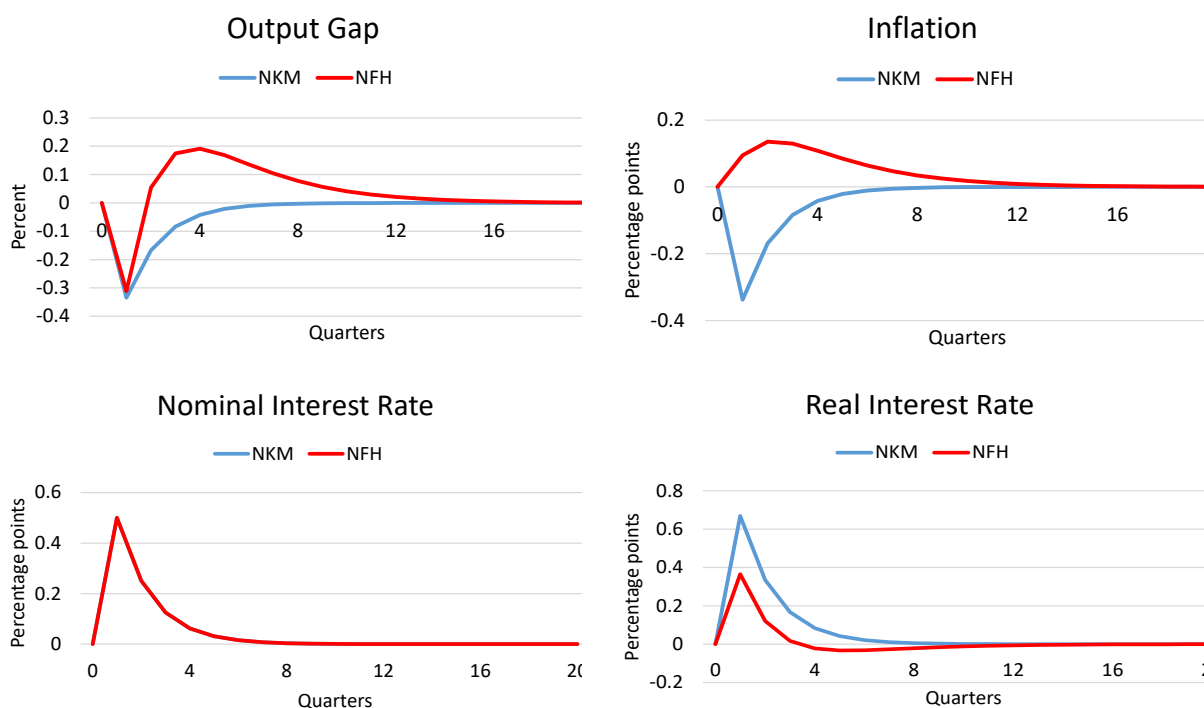
The model features a continuum of equilibria indexed by the constant C . In solving the model Cochrane chooses integration constant $C = 0$ and names this particular solution as “backward-stable”. “Backward-stable” implies that far future changes in monetary policy have smaller effects on the current variables than in the conventional new Keynesian model.

3. Conventional monetary policy

The Neo-Fisherian Hypothesis (NFH) works in principle in the same way as the standard New Keynesian model (NKM) except that the interest rate rule, where the nominal rate reacts to inflation and the output gap, is removed from the model. Instead, it is assumed that the level of the nominal interest rate is determined exogenously and can be raised or lowered at will, see Gali (2008) and Cochrane (2015). The difference between these two models is illustrated in Figure 1, which shows the response of key variables to a temporary but persistent monetary policy shock. Here the parametrization of both models follows Gali (2008).

The inflation responses of the two models is quite different. Fixing the interest rate does not allow any endogenous feedback between the output gap and the policy rate or between inflation and the policy rate. The key difference between the two models is that an unanticipated increase in the nominal interest rate leads to an increase in inflation in the Neo-Fisherian model and to a fall of inflation in the standard New Keynesian model. In addition, the output gap switches rapidly sign after the initial fall in the Neo-Fisherian model, while in the standard New Keynesian model, the output gap falls and then converges smoothly back to the initial steady state.

Figure 1 Responses of key variables to a temporary but persistent 50 basis points increase in the nominal interest rate



Source: Author's calculations, Gali (2008) and Cochrane (2015). NKM = New Keynesian Model, NFH = Neo-Fisherian Hypothesis

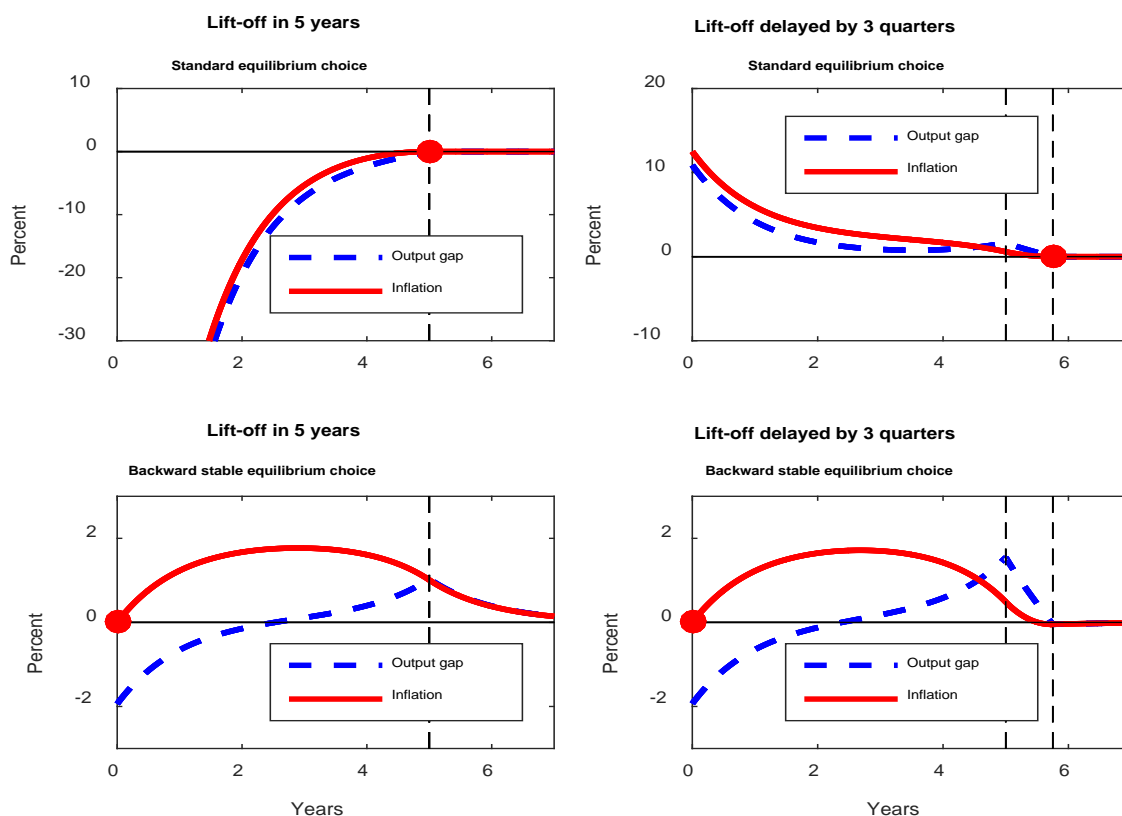
This comparison between the New Keynesian model and the Neo-Fisherian hypothesis shows strikingly different results. In the new Keynesian model monetary policy generates, via the Taylor principle, a liquidity effect while in the model based on the Neo-Fisherian hypothesis monetary policy is completely exogenized. We acknowledge that the comparison of models with such big differences in the underlying assumptions may not be entirely reasonable but this is after all the way models are typically contrasted.

4. Forward guidance

In the liquidity trap conventional monetary policy is unable to react to further negative shocks to the economy by lowering the policy rate. However, there still exists unconventional monetary policy in the form of forward guidance that can give conditional promises of future monetary policy actions. In this exercise we assume that a big negative natural rate shock hits the economy and drives it into the liquidity trap.

In the left hand panel of Figure 2 there is a temporary liquidity trap which lasts for 5 years, see Cochrane (2016a). In the top left corner are the results of a New Keynesian model which is solved with the standard equilibrium selection i.e. both the inflation and output gaps are zero after the liquidity trap. In the bottom left corner are the results of a Neo-Fisherian model. The backward stable selection makes the Neo-Fisherian impulse responses look rather stable compared to the standard New Keynesian model. Indeed inflation and the output gap in the new Keynesian model practically crash at the onset of the liquidity trap.

Figure 2 Forward guidance with different equilibrium choice



Source: Author's calculations and Cochrane (2016).

In the right hand panel of Figure 2 forward guidance is extended further by delaying the lift-off from the liquidity trap by three quarters. In the top right corner the New Keynesian model now produces positive output gaps and inflation rates. Thus, only a small change in very distant monetary policy promises changes outcomes in the New Keynesian model radically. This excess sensitivity to far future monetary policy promises in the New Keynesian model is called the forward guidance puzzle.

The right bottom panel of Figure 2 shows that forward guidance in the Neo-Fisherian model changes variables slightly just before the start of the new lift-off period. More importantly the short-run impact of forward guidance is very small and hence the very distant monetary policy promises have only limited effects in the Neo-Fisherian model.

5. Conclusions

The Neo-Fisherian hypothesis adopts a New Keynesian model which contains only a dynamic investment-savings balance and a Phillips curve describing the relation between economic activity and prices. Neo-Fisherian analysis abandons the usual interest rate rule and assumes that the interest rate is determined exogenously. The latter assumption generates a continuum of equilibria in the model. The Neo-Fisherians choose the equilibrium by the backward stable choice which, in formal terms, sets the constant of integration to zero.

Two key results of the Neo-Fisherian hypothesis are the following. First, an increase (decrease) in nominal policy rate increases (decreases) inflation also in short-run. Second, forward guidance has only small economic effects.

The critique of the Neo-Fisherian analysis concentrates on the assumption of backward stable equilibrium, which is seen as rather arbitrary. It is true that the backward stable equilibrium is among all potential equilibria but there is no convincing argument that just this equilibrium selection method should be used. That the method weakens the effects of forward guidance does not provide a strong argument in favor of choosing the implied equilibrium.

Garcia-Schmidt and Woodford (2015) reject the practical relevance of the perfect foresight equilibrium of the model under the thought experiment of a permanent interest-rate peg. Their proposed method of updating the conjectured expectations until they converge to correct expectations comes close to the learning methods of Evans and Honkapohja (2001).

Gabaix (2016) builds an argument on the bounded rational expectations premises and introduces cognitive discounting in the model. This type of discounting may help to explain why forward guidance can be weaker than implied by the standard new Keynesian model.

The result of the Neo-Fisherian analysis whereby the central bank can steer inflation to the same direction as the policy rates is in conflict with what the economic profession has learned in the last 200 years and based on this collective meta-analysis this result seems less credible. The second result that forward guidance may be weaker than thought in the plain vanilla New Keynesian model seems reasonable but then again the forward guidance puzzle may tell us more about how strong the assumption of rational expectations is.

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Appendix Backward stable equilibrium

Cochrane (2016) and Werning (2012) assume a New Keynesian model in continuous time:

$$\text{DIS} \quad \frac{dy_t}{dt} = \sigma(i_t - r_t - \pi_t)$$

$$\text{Phillips curve} \quad \frac{d\pi_t}{dt} = \rho\pi_t - \kappa y_t$$

Letting $ir_t = i_t - r_t = \begin{cases} ir, & t < T \\ 0, & t \geq T \end{cases}$ and scaling DIS by κ then the above can be written in matrix form

$$\frac{d}{dt} \begin{bmatrix} \kappa y_t \\ \pi_t \end{bmatrix} = \kappa \begin{bmatrix} ir_t \\ 0 \end{bmatrix} + \begin{bmatrix} 0 & -\kappa \\ -1 & \rho \end{bmatrix} \begin{bmatrix} \kappa y_t \\ \pi_t \end{bmatrix}$$

Steady-state

$$\begin{aligned} \pi &= ir \\ \kappa y &= \rho ir \end{aligned}$$

$$\text{Differentiating the Phillips curve} \quad \frac{d^2 \pi_t}{dt^2} = \rho \frac{d\pi_t}{dt} - \kappa \frac{dy_t}{dt}$$

$$\text{Inserting the DIS curve to this} \quad \frac{d^2 \pi_t}{dt^2} - \rho \frac{d\pi_t}{dt} - \kappa \sigma \cdot \pi_t = -\kappa \sigma \cdot ir_t$$

$$\text{Homogeneous equation} \quad \frac{d^2 \pi_t}{dt^2} - \rho \frac{d\pi_t}{dt} - \kappa \sigma \cdot \pi_t = 0$$

$$\text{Characteristic equation} \quad \lambda^2 - \rho\lambda - \kappa\sigma = 0$$

$$\text{Characteristic roots} \quad \lambda^f = \frac{1}{2}(\rho + \sqrt{\rho^2 + 4\kappa\sigma}) \geq 0$$

$$\lambda^b = \frac{1}{2}(\rho - \sqrt{\rho^2 + 4\kappa\sigma}) \leq 0$$

As one root is positive and the other is negative the system is saddle point stable. Characteristic roots have further properties $\lambda^b + \lambda^f = \rho$, and $\lambda^b \cdot \lambda^f = -\kappa\sigma$.

The above equation can be thus written as

$$\left(\frac{d}{dt} - \lambda^f\right) \left(\frac{d}{dt} - \lambda^b\right) \pi_t = -\kappa\sigma \cdot ir_t$$

In order to invert the above notice that

$$\left(\frac{d}{dt} - \lambda^f\right) \pi_t = -\kappa\sigma \cdot ir_t$$

Multiply with integrating factor $e^{-\lambda^f t}$

$$\frac{d}{dt} \left(e^{-\lambda^f t} \pi_t \right) = -\kappa\sigma \cdot e^{-\lambda^f t} ir_t$$

↔

$$e^{-\lambda^f t} \pi_t = C^n - \kappa\sigma \cdot \int_{-\infty}^t e^{-\lambda^f s} ir_s ds$$

This converges to a stable solution if $\lim_{t \rightarrow \infty} e^{-\lambda^f t} \pi_t = 0$ i.e. $C^m = \kappa\sigma \cdot \int_{-\infty}^{\infty} e^{-\lambda^f s} i r_s ds$

\Leftrightarrow

$$e^{-\lambda^f t} \pi_t = \kappa\sigma \cdot \int_{-\infty}^{\infty} e^{-\lambda^f s} i r_s ds - \kappa\sigma \cdot \int_{-\infty}^t e^{-\lambda^f s} i r_s ds = \kappa\sigma \cdot \int_t^{\infty} e^{-\lambda^f s} i r_s ds$$

Multiply with $e^{\lambda^f t}$

$$\pi_t = \kappa\sigma \cdot \int_t^{\infty} e^{-\lambda^f (s-t)} i r_s ds$$

Notice also that

$$\left(\frac{d}{dt} - \lambda^b\right) \pi_t = \kappa\sigma \cdot i r_t$$

Multiply with integrating factor $e^{-\lambda^b t}$

$$\frac{d}{dt} (e^{-\lambda^b t} \pi_t) = \kappa\sigma \cdot e^{-\lambda^b t} i r_t$$

Integrate from $-\infty$ to t and multiply with $e^{\lambda^b t}$

$$\pi_t = C^l e^{\lambda^b t} + \kappa\sigma \cdot \int_{-\infty}^t e^{\lambda^b (t-s)} i r_s ds$$

Write the second order differential equation

$$\left(\frac{d}{dt} - \lambda^f\right) \left(\frac{d}{dt} - \lambda^b\right) \pi_t = -\kappa\sigma \cdot i r_t$$

as

$$\begin{aligned} \pi_t &= \frac{-1}{\left(\frac{d}{dt} - \lambda^f\right) \left(\frac{d}{dt} - \lambda^b\right)} \kappa\sigma \cdot i r_t = \frac{1}{\lambda^f - \lambda^b} \left[\frac{-(\lambda^f - \lambda^b)}{\left(\frac{d}{dt} - \lambda^f\right) \left(\frac{d}{dt} - \lambda^b\right)} \right] \kappa\sigma \cdot i r_t = \\ &= \frac{1}{\lambda^f - \lambda^b} \left[\frac{\frac{d}{dt} - \lambda^f - \frac{d}{dt} + \lambda^b}{\left(\frac{d}{dt} - \lambda^f\right) \left(\frac{d}{dt} - \lambda^b\right)} \right] \kappa\sigma \cdot i r_t \\ &= \frac{1}{\lambda^f - \lambda^b} \left[\frac{1}{\frac{d}{dt} - \lambda^b} - \frac{1}{\frac{d}{dt} - \lambda^f} \right] \kappa\sigma \cdot i r_t \end{aligned}$$

Inserting the above solutions to the first order linear differential equations yields the solution for the inflation

$$\pi_t = C e^{\lambda^b t} + \frac{\kappa\sigma}{\lambda^f - \lambda^b} \left[\int_{s=-\infty}^t e^{\lambda^b (t-s)} i r_s ds + \int_{s=t}^{\infty} e^{-\lambda^f (s-t)} i r_s ds \right],$$

where $C = \frac{C^l}{\lambda^f - \lambda^b}$. Inserting this back to the Phillips curve and utilizing Leibnitz rule yields the output gap

$$\kappa \cdot y_t = \lambda^f C e^{\lambda^b t} + \frac{\kappa \sigma}{\lambda^f - \lambda^b} \left[\lambda^f \int_{s=-\infty}^t e^{\lambda^b(t-s)} i r_s ds + \lambda^b \int_{s=t}^{\infty} e^{-\lambda^f(s-t)} i r_s ds \right]$$

In solving the model Cochrane chooses $C = \mathbf{0}$ and names this particular solution as “backward-stable”.