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PROGNOZIRANJE INFLACIJE - POREĐENJE IZMEĐU KONVENCIONALNE FILIPSOVE KRIVE I NOVO KEJNZIJANSKE FILIPSOVE KRIVE

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Rezime

Postojanje odnosa između kamatnih stopa i inflacije dobro je poznata činjenica i mnoga istraživanja su usmerena na utvrđivanje doprinosa inflacije kod stvarnih i prognoziranih kamatnih stopa. Međutim, ti radovi ne uzimaju u obzir da je prognoziranje inflacije kompleksno pitanje, koje ostaje u velikoj meri nerazjašnjeno do danas. Tradicionalno, većina mera inflacije i predviđanja usmerena je na istorijske podatke i odnose uspostavljene između istorijske inflacije i varijabli realne ekonomije koje su postojale u to vreme. Pošto je precizna mera inflacije centralno pitanje u makroekonomiji i naročito u analizi monetarne politike, ovaj rad prikazuje pregled modela progonoziranja inflacije i evaluira njihovu preciznost i upotrebljivost za prognoziranje budućih ekonomskih trendova. Ispitaće se različite varijante klasične Filipsove krive, zasnovane na stopi nezaposlenosti koja ne ubrzava inflaciju (NAIRU). To će biti upoređeno sa najnovijim razvojem u modeliranju inflacije, poznatim kao Kejnzijanska Filipsova kriva.

Ključne reči: prognoziranje inflacije, konvencionalne Filipsove krive, Nova Kejnzijanska Filipsova kriva, modeli prognoziranja inflacije, NAIRU, nezaposlenost

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INFLATION FORECASTING - A COMPARISON BETWEEN CONVENTIONAL PHILLIPS CURVES AND NEW KEYNESIAN PHILLIPS CURVE

Summary

The existence of the relationship between interest rates and inflation is a well known fact and much research has focused on establishing the contribution of inflation in the observed and forecast interest rates. However, what such works fail to consider is that inflation forecasting as a complex issue, one that remains largely unresolved to this day. Traditionally, most inflation measures and forecasts focused on historical data and the relationships established between historical inflation and real economic variables observed at the time. As accurate inflation measure is a central issue in macroeconomics and especially in monetary policy analysis, this paper will present an overview of the inflation forecasting models and make an evaluation of their accuracy and usefulness in forecasting future economic trends. Different variants of classic Phillips Curve, all based on the non-accelerating inflation rate of unemployment (the NAIRU), will be examined. This will be contrasted with the latest developments in inflation modelling, known as Keynesian Phillips Curve.

Key words: Inflation forecasting, conventional Phillips Curves, New Keynesian Phillips Curve, inflation forecasting models, NAIRU, unemployment

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Uvod

Modeli inflacije prikazuju odnos između stope nezaposlenosti, neke druge mere ekonomske aktivnosti, ili najuobičajenije skupa različitih ekonomskih varijabli, i stope inflacije. Mada ima mnogo varijacija u ovom pristupu, većina ih se oslanja na trenutni nivo zaposlenosti (ili ekvivalentnu meru stanja ekonomije) da bi se izveli budući nivoi inflacije i tradicionalno su poznati kao Filipsove krive. Taj pristup modeliranju inflacije počiva na premisi da postoji neki "standardni" nivo nezaposlenosti, prema kome se meri tekući nivo i na taj način inflacija. Smatra se da su te dve veličine inverzno povezane, tako da kada nezaposlenost padne ispod "standarda", inflacija raste i obrnuto. Ovaj konceptualni "reperni" nivo nezaposlenosti uobičajeno se u odgovarajućoj literaturi naziva *stopom nezaposlenosti koja ne ubrzava inflaciju* (NAIRU). Prema tome, modeli inflacije zasnovani na njoj poznati su kao *NAIRU Filipsove krive.* Većina teoretičara i donosilaca politike i dalje se drže gledišta da su tekući nivoi nezaposlenosti upotrebljivi indikatori budućeg kretanja stope inflacije, što je potvrđeno relativnim empirijskim uspehom tog pristupa. Mada je u poslednjim decenijama odnos između inflacije i nezaposlenosti počeo da se ruši, korisno je razmotriti u ovom radu neke od najpopularnijih NAIRU Filipsovih krivih, da bi se potencijalno identifikovali nedostaci ovog simplicističkog pogleda na buduća makroekonomska kretanja, u poređenju sa najnovijim razvojem - konkretno Kejnzijanskom Filipsovom krivom, koja je sastavni deo Kejnzijanske teorije (što se kratko opisuje u daljem tekstu) i ima moderniji pristup kod izbora inputa podataka u model.

Pregled Filipsovih krivih

Inflacija je u centru pažnje teretskog rada i donošenja politike već skoro jedan vek. Prvi koji je povezao inflaciju sa nivoima nezaposlenosti bio je Fišer (1926), koristeći podatke Sjedinjenih država da bi modelirao odnos između te dve varijable. Kasnije su Filips (1958) i Samuelson i Solow (1960) predložili negativan odnos između stope nezaposlenosti (kao procenat raspoložive radne snage) i stope rasta nominalnog ličnog prihoda (blisko povezanog sa inflacijom). Zahvaljujući ovom pionirskom radu, svi budući modeli inflacije postali su poznati kao Filipsove krive. Međutim, ubrzo su se pojavili kritičari, osporavajući stabilnost ovog statističkog odnosa. Mnogi praktičari, kao što su Fridman (1968), Felps (1969), Fišer (1977) i Tejlor (1980), tvrdili su da sistemski odnos između bilo koje dve ekonomske varijable nije viđen u praksi. Umesto toga, oni su predložili da, u skladu sa ekonomskom teorijom, očekivanja buduće inflacije treba da variraju sa promenama u ekonomskom okruženju, tako da istorijski stvarni odnos između tekuće nezaposlenosti i buduće inflacije ima malo uticaja na prognoze inflacije u izričito različitoj ekonomiji. Konkretno, u odsustvu stabilnog ekonomskog okruženja, modeli zasnovani na fiksnom odnosu između inflacije i nezaposlenosti implicitno su pogrešni, jer su njihove teoretske pretpostavke utemeljene na malo empirijskih dokaza o njihovoj validnosti. Kao što su Atkenson i Ohanian (2001) prikazali u svom pregledu istorijskih Filipsovih krivih i saglasnosti njihovih predviđanja sa stvarnim nivoima inflacije, negativna korelacija između inflacije i nezaposlenosti pokazala se istinskom tokom 1960-tih godina. Međutim, pošto je tokom 1970-tih godina i praktično do kraja 20. veka, inflacija bila i veća i volatilnija, taj odnos se pokvario, dajući jasan signal da prvobitne pretpostavke u osnovi Filipsovih krivih nisu više primenljive. Uprkos čvrstom i nepobitnom dokazu da modeliranje inflacije treba da se zasniva na modernijem i znatno širem spektru parametara, mnogi praktičari još uvek koriste tradicionalni pristup i mnogi ekonomisti se oslanjaju na njegov autput kod donošenja politike. Pošto mnogi ekonomisti i dalje tvrde da postoji stvarna veza između nezaposlenosti i buduće inflacije, pojavio se novi pristup, kojim se prognoziraju *promene u inflaciji*, a ne inflacija per se. Taj pristup je uobičajeno poznat kao NAIRU (*stopa nezaposlenosti koja ne ubrzava inflaciju)* Filipsova kriva. Neki od najpoznatijih modela uključuju onaj koji su razvili Stok i Vatson (1999a, b), koji su tvrdili da istorijski stabilan negativan odnos između tekuće stope nezaposlenosti i kasnije promene stope inflacije treba i dalje da budu kameni temeljci svih prognoza inflacije. Obuhvatne studije preciznosti modela zasnovanih na NAIRU Filipsovoj krivi u

Introduction

Inflation models describe the relationship between the unemployment rate, some other measure of economic activity, or most commonly an aggregate of different economic variables, and the inflation rate. Although there are many variations to this approach, most rely on current level of employment (or an equivalent measure of the state of the economy) in order to derive future levels of inflation and are traditionally known as Phillips Curves. This approach to inflation modelling rests on the premise that there is some 'baseline' level of unemployment, relative to which the current level, and thus inflation is measured. The two are deemed inversely related, so that when unemployment falls below the 'baseline', inflation rises and vice versa. This conceptual 'benchmark' level of unemployment is commonly referred to in the pertinent literature as *non-accelerating inflation rate of unemployment* (*NAIRU*). Thus, inflation models based on it are known as *NAIRU Phillips curves.* Most academics and policymakers still hold the view that current unemployment levels are useful indicators of the future path of the inflation rate, as this is justified by the relative empirical success of this approach. Although, in recent decades, the relationship between inflation and unemployment started to break down, it is useful to consider some of the most popular NAIRU Phillips curves in this paper, in order to potentially indentify the shortcomings in this simplistic view of future macroeconomic developments, contrasting it with the latest developments—in particular Keynesian Phillips Curve, which in nested in the Keynesian theory (briefly described later) and takes a more forward-looking approach in the selection of the model input data.

An Overview of Phillips Curves

Inflation has been the focus of both academic work and policy setting for almost a century. The first to relate it to unemployment levels was Fisher (1926), who used US data to model the relationship between the two variables. Later, Phillips (1958) and Samuelson and Solow (1960) proposed a negative relationship between the unemployment rate (as a percentage of the available labour force) and the rate of nominal personal income growth (closely linked to inflation). Owing to this pioneering work, all future inflation models thus became known as Phillips Curves. However, critics soon appeared, questioning the stability of this statistical relationship. Many practitioners, including Friedman (1968), Phelps (1969), Fischer (1977), and Taylor (1980), argued that systematic relationship between any two economic variables in not observable in practice. Instead, they proposed that, in line with the economic theory, expectations of future inflation should vary with the changes in the economic environment, thus historically observed relationship between current unemployment and future inflation would have little bearing on the inflation forecasts in a markedly different economy. In particular, in the absence of stable economic environment, models based on fixed relationship between the inflation and unemployment are implicitly flawed, as their theoretical assumptions are founded on little empirical evidence of their validity. As Atkeson and Ohanian (2001) showed, in their review of historically significant Phillips curves and the compatibility of their predictions with the actual inflation levels, the negative correlation between inflation and unemployment held true in the 1960s. However, as in the 1970s, and practically throughout the rest of the 20th century, inflation was both higher and more volatile, this relationship broke down, signalling that the initial assumptions underlying the Phillips curves are clearly no longer applicable. Despite firm and unequivocal evidence that inflation modelling should be based on more forward looking and much broader spectrum of parameters, many practitioners still use the traditional approach and many economists rely on its output in policy making. As many economists still maintain that there is an observable link between unemployment and future inflation, a new approach emerged, whereby it is the *changes in the inflation*, rather than inflation per se that is forecast. Such approach is commonly known as NAIRU (non-accelerating inflation rate of unemployment) Phillips Curve. Some of the most well known models include that developed by Stock and Watson (1999a,b), who

prognoziranju inflacije koje su sproveli Mankiv (2000) i Fišer (2000) mogu da pruže neki uvid u njihovu upitnu validnost. Nezavisno od toga, ne samo da modeli zasnovani na NAIRU Filipsovoj krivoj ostaju popularni kod teoretičara, samo pre jednu deceniju, donosioci politike su i dalje inkorporisali njihov autput u široke ekonomske prognoze. Ipak, kao priznanje nedostataka prognoza zasnovanih na istorijskim podacima, nedavno je fokus pomeren na novu vrstu pristupa, gde se inflacija modelira na varijablama okrenutim prema budućnosti. Tako se pojavila se nova vrsta krive - Nova Kejnzijanska Filipsova kriva (videti na pr. Tejlor 1980; Kalvo, 1983; Roberts, 1995) - implicirajući da na nivo tekuće inflacije utiču nivo koji se očekuje u narednom periodu i gep autputa ili realan trošak radne snage. Međutim, njenu empirijsku validnost je doveo u pitanje Roberts (2005). Rud i Velan (2005a, b) isto tako su favorizovali modele prognoziranja inflacije pogledom u prošlost u odnosu na alternative okrenute prema budućnosti. Deceniju ranije, Fuhrer i Moore (1995) već su tvrdili da se standardni Novo Kejnzijanski model, zasnovan na racionalnim očekivanjima, nije uklapao u istorijske podatke. Ima mnogo pristalica tog pristupa takođe, kao što su, na primer, pokazali radovi Furera (1997a) i Robertsa (1997) da modeli koji uključuju kašnjenja inflacije rešavaju ovo pitanje. Dalji dokazi validnosti Novo Kejnzijanske Filipsove krive dali su Čada, Mason i Meredit (1992) i Roberts (1998), kao i Gal´i Gertler (1999), Gal´, Gertler i L'opez-Salido (2001) i Sbordone (2001, 2001).

Otuda, pri datim suprotstavljenim gledištima o postojećim inflacionim krivama u odnosnoj literaturi, valja ukratko sumirati njihove respektivne osnovne jednačine, da bi se bacilo svetlo na funkcionisanje tih modela. Na taj način, postaje očiglednije da li je moguće da se precizno predvidi bilo koja ekonomska varijabla i tako implicitno i inflacija.

Specifikacija NAIRU Filipsove krive

Pošto se izraz "Filipsova kriva" odnosi na opšti pristup modeliranju inflacije, zasnovnom na tekućem nivou nezaposlenosti, tokom godina se pojavilo mnogo varijacija. Nezavisno od toga, jednostavan matematički izraz može da ima formu:

$$E_t(i_{t+4} - i_t) = \alpha(u_t - u_N$$

gde:
E_t označava očekivanja, i_{t+4} je inflacija u naredna četiri kvartala, i_t je procentualna promena u četiri poslednja kvartala. Desna strana jednačine je funkcija koja određuje model inflacije, a u napred datom primeru predstavlja krivu koja obeležava razliku između tekuće posmatrane nezaposlenosti i one koju daje NAIRU model, gde α označava nagib krive.

Jasno, u svojoj najjednostavnijoj formi, gornji odnos može da se modelira sa $\alpha = 0$, što implicira da nema promene inflacije. Koliko god da to izgleda neobično, Atkenson i Ohanian (2001) pokazali su da ovaj simplicistički pristup ne zaostaje za standardnim modelom u pogledu svoje saglasnosti sa istorijskim podacima. Prema tome, izgleda da modeli inflacije ne moraju nužno da imaju koristi od kompleksnosti već pre od izbora parametara za input.

Otuda, vredi razmotriti alternativni pristup, neznatnu modifikacija modela koji su predložili Stock i Vatson (1999a), koji modelira inflaciju u toku 12 narednih meseci i može da uključi nekoliko ekonomskih varijabli kao inpute u model. U svojoj uopštenoj formi, daje se kao:

$$i_{t+12}^{12} - i_t^{12} = \alpha + \beta(L)x_t + \gamma(L)(i_t - i_{t-1}) + \varepsilon_{t+12}$$

gde:
leva strana jednačine predstavlja razliku između prognoze 12-mesečne inflacije i stvarne inflacije u prethodnoj godini. Desna strana je polinom koji može primiti niz inputa, jer je efekat x_i, nezaposlenost ili indeks ekonomske aktivnosti koji služi kao indikator inflacije, određen L operatorom koji inkorporira varijable kašnjenja uključene u model (tj. β (L) i γ (L) su polinom koji inkorporiše broj kasnih inputa x_t i i_t respektivno). Najzad, α je predeterminisana razlika konstante, a ε je izraz za slučajnu grešku. Još jednom, u svojoj najjednostavnijoj formi, model može da uzme da je $\alpha = \beta$ (L) = γ (L) = 0, što implicira da su inflaciju tokom narednih 12 meseci perfektno prognozirali stvarni nivoi iz prethodne godine.

Atkeson i Ohanian (2001) obavili su

claimed that the historically stable negative relationship between the current rate of unemployment and subsequent changes in the rate of inflation should still be the cornerstone of any inflation forecasts. Comprehensive studies of the accuracy of the NAIRU Phillips curve-based models in forecasting inflation have been conducted by Mankiw (2000) and Fisher (2000) and can offer some insight into their questionable validity. Nonetheless, not only do the NAIRU Phillips curve-based models remain popular amongst academics, only a decade ago, policy makers were still incorporating their output into the broad economic forecasts. However, in recognition of the shortcomings of the forecasts based on historical data, the focus has recently shifted to a new kind of approach, whereby inflation is modelled on forward-looking variables. Thus, a new type of curve—New Keynesian Phillips Curve (see e.g. Taylor 1980; Calvo, 1983; Roberts, 1995)—emerged, implying that current inflation level is influenced by that expected in the next period and the output gap or real unit labour cost. However, its empirical validity has also been brought into question by Roberts (2005). Rudd and Whelan (2005a,b) also favoured traditional backward-looking inflation forecasting models to the forward-looking alternatives. A decade earlier, Fuhrer and Moore (1995) already argued that the standard New Keynesian model based on rational expectations did not fit historical data. There are many supporters of this approach too, as, for example, work by Fuhrer (1997a) and Roberts (1997) showed that models that included lags of inflation overcame this issue. Further evidence of the validity of New Keynesian Phillips curve is given by Chadha, Masson, and Meredith (1992) and Roberts (1998), as well as Gal´ı and Gertler (1999), Gal´ı, Gertler, and L´opez-Salido (2001), and Sbordone (2001, 2002).

Thus, given the contrasting views of extant inflation curves in the pertinent literature, it is worth briefly summarising their respective underlying equations, in order to shed the light into the workings of these models. In doing so, it will become more apparent if it is possible to accurately predict any economic variable, and thus implicitly inflation.

The NAIRU Phillips Curve Specification

As the term 'Phillips Curve' refers to the general approach to inflation modelling, based on current level of unemployment, many variations have emerged over the years. Nonetheless, a simple mathematical representation can take the form:

$$E_t(i_{t+4} - i_t) = \alpha(u_t - u_N)$$

where:
E_t denotes expectation, i_{t+4} is the inflation for the next four quarters, i_t is the percentage change in the most recent four quarters. The right hand side of the equation is the function that determines the inflation model, and in the case given above it represents a curve plotting the difference between currently observed unemployment and that given by NAIRU model, with α indicating the slope of the curve.

Clearly, it its most simplistic form, the relationship above can be modelled with $\alpha = 0$, implying no change in the inflation. As counterintuitive as it seems, Atkeson and Ohanian (2001) have shown that this simplistic approach does not lag behind the standard model in terms of its fit to the historical data. Thus, it appears that inflation models do not necessarily benefit from complexity, but rather the choice of input parameters.

Hence, it is worth considering an alternative approach, a slight modification of the model proposed by Stock and Watson (1999a), which models the inflation over the next 12 months, and can include several economic variables as model inputs. In its generic form, it is given as:

$$i_{t+12}^{12} - i_t^{12} = \alpha + \beta(L)x_t + \gamma(L)(i_t - i_{t-1}) + \varepsilon_{t+12}$$

where:
the left hand side of the equation represents the difference between the forecast 12-month inflation and that observed in the preceding year. The right hand side is a polynomial that can accommodate a range of inputs, as the effect of x_t, the unemployment or economic activity index that serves as the inflation indicator, is determined by L—the operator

ekstenzivnu analizu ovog pristupa modeliranju inflacije, koristeći nezaposlenost i indeks ekonomske aktivnosti kao x_t i prikazali da se ne mogu postići nikakva značajna poboljšanja povećanjem kompleksnosti modela, u poređenju sa jednostavnim posmatranjem istorijskih podataka. Ovo izgleda sugeriše da pristup pogleda unatrag na prognoziranje inflacije nije zaista koristan i da istraživači i praktičari moraju da pređu na Novo Kejnzijanski model, koji se ukratko opisuje u daljem tekstu.

Specifikacija Novo Kejnzijanske Filipsove krive

Izraz "Kejnzijanski" proizilazi iz dobro poznatog koncepta Kejnzijanske ekonomije (poznata i kao Kejnzijanizam i Kejnzijanska teorija), koja se odnosi na makroekonomsku školu mišljenja zasnovanu na idejama ekonomiste iz 20. veka, Džona Majnarda Kejnza. U suštini, pristalice ove teorije tvrde da racionalne akcije koje preduzima dovoljan broj pojedinaca ili privatnih firmi mogu da imaju makroekonomske implikacije, tipično vodeći do neefikasnih agregatnih makroekonomskih ishoda. Na primer, odluka dovoljnog broja kompanija da menjaju svoj poslovni plan mogu rezultirati padom agregatne tražnje za robom, što sa svoje strane vodi do smanjenog autputa i time do visoke nezaposlenosti. Ovaj ciklus se ponavlja dok na kraju ne proizvede promene na makroekonomskom nivou. Prema Kejnzijanskoj teoriji, to zahteva aktivnu stabilizacionu politiku vlade, sa ciljem da se umanji amplituda ovog neizbežnog poslovnog ciklusa, kroz smanjenje kamatnih stopa ili investiranje u infrastrukturu (implicirajući povećanje ekonomske aktivnosti, smanjenje nezaposlenosti i stvaranje deflacije) ili oba. Ova se teorija naročito suprotstavlja pristupima klasične ekonomije koja zastupa prisutnost opšte tendencije prema ravnoteži, tvrdeći umesto toga da nikakav mehanizam, nezavisno od toga koliko je snažan ili proaktivan, ne može ikada ostvariti punu zaposlenost.

Vraćajući se prognoziranju inflacije, Novo Kejnzijanska kriva modelira inflaciju kao funkciju očekivane buduće stope inflacije, gepa autputa ili realne jedinice troškova radne snage (Lind'e, 2005). To je empirijski solidan pristup, jer stoji na makroekonomskim temeljima. Dalje, mada je koncept iza tog pristupa daleko kompleksniji, u poređenju sa modeliranjem koje je zasnovano na istorijskim i tekućim podacima, nekoliko autora je pokazalo da se traženi inputi mogu opaziti u praksi, kroz optimalne odgovore učesnika na tržištu, koji prilagođavaju cene kao odgovor na ekonomske uslove (Roberts, 1995; Rotemberg, 1982; Kalvo, 1983).

U svojoj osnovnoj formi, Novo Kejnzijanska kriva inkorporiše cene koje postavljaju konkurentne firme, orijentisane prema monopolu u svom odabranom sektoru tržišta (Brisimis & Maginas, 2008). Tako, inflacija se može izraziti kao

$$i_t = \frac{(1-p)(1-p\beta)}{p-p\gamma\eta} s_t + \beta E_t i_{t+1}$$

gde je i_t stopa inflacije u periodu t, i_{t+1} je očekivana inflacija u narednom periodu, E_t je funkcija očekivanja, p je verovatnoća da cene koje su postavile monopolističke firme ostaju nepromenjene (ili barem proporcionalne tekućem inflacionom trendu) u narednom periodu, γ je elastičnost tražnje firme (tj. mera procentualne promene u tražnji za proizvodom kao odgovor na promene ekonomskih okolnosti), i η je elastičnost marginalnih troškova u pogledu autputa (tj. procentualna promena proizvodnih troškova proizvoda u odnosu na fluktuacije u autputu).

Suvišno je reći, ovaj novi model je privukao mnogo kritika praktičara i teoretičara, koji su tvrdili da taj model ne uspeva da uhvati ne samo troškove prilagođavanja inflaciji (na pr. Fuhrer & Moore, 1995), već i činjenicu da ne bi sve firme reagovale na promene u ekonomiji na aktivan i blagovremen način (Furer, 1997b; Roberts, 1998; Gal´ i Gertler & L'opez-Satido, 2005). Na taj način, da bi se inkorporisala kašnjenja inflacije, tj. otklonilo oslanjanje na čisto racionalna očekivanja, Gal´ i Gertler (1999) razvili su model koji dozvoljava da deo firmi koristi retro pristup u svom upravljanju troškovima. Jasno, trenutno ni jedan model ne može precizno da prognozira inflaciju; otuda naredna diskusija nudi neka gledišta o nedostacima pristupa koji su korišćeni do sada za rešavanje ove kritične ekonomske varijable.

that incorporates the lag variables included in the model (i.e. β(L) and γ(L) are polynomials incorporating the number of lagged inputs of x_t and i_t respectively). Finally, α is a predetermined constant difference and ε is the error term. Once again, in its simplest form, the model can assume α = β(L) = γ(L) = 0, implying that the inflation over the next 12 months is perfectly predicted by the levels observed in the last year.

Atkeson and Ohanian (2001) have run an extensive analysis of this inflation modelling approach, using both unemployment and economic activity index as x_t and have shown that no marked improvements can be achieved by increasing model complexity, compared to the simple observation of historical data. This seems to suggest that the backward looking approach to inflation forecasting is, indeed, not useful and researchers and practitioners must move towards the New Keynesian model, which is briefly described below.

The New Keynesian Phillips Curve Specification

The term 'Keynesian' derives from the well-known concept of Keynesian economics (also known as Keynesianism and Keynesian theory), which refers to the macroeconomic school of thought based on the ideas of 20th century economist John Maynard Keynes. In essence, the supporters of this theory argue that rational actions taken by sufficient number of individuals or private firms can have macroeconomic level implications, typically leading to inefficient aggregate macroeconomic outcomes. For example, decision by sufficient number of companies to change their business plan can result in a decline in an aggregate demand for goods, which in turn leads to reduced output and thus high unemployment. This cycle perpetuates, ultimately effecting the changes at macroeconomic level. According to Keynesian theory, this calls for an active stabilisation policy on behalf of the government, with the aim to reduce the amplitude of this inevitable business cycle, either through reduction in interest rates or investment in infrastructure (implicitly increasing economic activity, reducing unemployment and causing deflation) or both. Most notably, this theory contradicts the classical economic approaches that advocate for the presence of general tendency towards an equilibrium, claiming instead that no mechanism, irrespective of how strong or proactive, would ever achieve full employment.

Returning to the inflation forecasting, the New Keynesian curve models the inflation as a function of the expected future inflation rate and either the output gap or the real unit labour cost (Lind´e, 2005). This is empirically sound approach, as it rests on macroeconomic foundations. Moreover, although the concept behind this approach is far more complex, compared to the modelling based on the historical and current data, several authors have shown that the required inputs can be observed in practice, through optimal responses of market participants, who adjust prices in response to economic conditions (Roberts, 1995; Rotemberg, 1982; Calvo, 1983).

In its basic form, the New Keynesian curve incorporates prices set by competitive firms, oriented towards monopoly in their chosen market sector (Brissimis & Magginas, 2008). Thus, inflation can be expressed as:

$$i_t = \frac{(1-p)(1-p\beta)}{p-p\gamma\eta} s_t + \beta E_t i_{t+1}$$

where i_t is the inflation rate in the period t, i_{t+1} is the expected inflation in the following period, E_t is the expectation function, p is the probability of the prices set by the monopolistic firms remaining unchanged (or at least proportional to the current inflation trend) in the next period, γ is the firm's demand elasticity (i.e. the measure of percentage change in product demand in response to changes in economic conditions), and η is elasticity of marginal cost with respect to output (i.e. the percentage change in product production cost in relation to fluctuations in output).

Needless to say, this new model attracted much criticism, both from practitioners and the academics, who argued that the model failed to capture not only costs of inflation adjustment (e.g. Fuhrer & Moore, 1995), but also the fact that not all firms would be reacting to changes in the economy in the active and timely manner (Fuhrer, 1997b; Roberts, 1998; Gal´ı, Gertler, & L´opez-Salido, 2005). Thus, in order

Diskusija

Teorije koje podržavaju napred navedene modele inflacije oslanjaju se na koncept racionalnih očekivanja agenasa i NAIRU (stopa nezaposlenosti koja ne ubrzava inflaciju), uglavnom zbog činjenice da takav pristup može da prihvati stagflaciju (gde visoku stopu inflacije prate usporavanje ekonomskog rasta i visoka nezaposlenost). Prema NAIRU teoriji, izvesni nivoi nezaposlenosti vode do stabilne dugoročne inflacije. Međutim, donosioci politike moraju da donose kratkoročne odluke, uglavnom birajući da smanje stopu nezaposlenosti, kroz ekspanzionu politiku. Ovo sa svoje strane povećava inflaciona očekivanja, čineći smanjenje nezaposlenosti samo privremenim i vodi čak do više inflacije na duži rok.

Zato, ekspanziona politika na kraju pogoršava isključivost između nezaposlenosti i inflacije, rezultirajući višom inflcijom koja odgovara svakoj kasnijoj kratrkoročnoj stopi nezaposlenosti. Nasuprot tome, NAIRU teorija implicira da postoji "reperni" nivo nezaposlenosti ispod koga se inflacija ubrzava i obrnuto. To implicira da na NAIRU nivou nezaposlenosti inflcija treba da ostane stabilna, tj. da se niti ubrzava niti usporava.

Dalje, zagovornici teorije racionalnih očekivanja uzimaju da očekivana i stvarna inflacija treba da se u praksi najvećim delom podudaraju, dopuštajući neka mala i privremena mimoilaženja. Povezujući ovaj koncept sa NAIRU, očigledno je da on implicira da svake kratkoročne promene ostaju ograničene na vrlo kratke, virtuelno nepostojeće periode. Otuda bi svaki napor da se nivoi nezaposlenosti udalje od NAIRU odmah izazivao saglasno pomeranje inflatornih očekivanja, implicitno uzrokujući neuspeh politike. Drugim rečima, bilo koje devijacije nivoa nezaposlenosti od NAIRU nastale bi zbog nasumičnih i prolaznih grešaka kod "racionalnih" očekivanja u pogledu budućih inflacionih stopa.

Međutim, pred kraj 20. veka, sa promenama ekonomskih uslova postalo je sve više očigledno da nije postojala jedinstvena i stabilna NAIRU ravnoteža. Tako, pošto su istorijski popularni modeli inflacije počeli da se ne uklapaju u stvarne ekonomske podatke, Filipsova kriva i koncept NAIRU postali su predmet debate. Ovo je sa svoje strane otvorilo pitanja u pogledu validnosti teorije racionalnih očekivanja, jer je ona isto tako bila zasnovana na premisi da postoji predvidiva, stabilna i jedinstvena ravnoteža u ekonomiji. Jasno, ova pretpostavka ne može dalje da bude održiva.

Zaključak

S obzirom na značaj inflacije i prognoziranja stope inflacije u donošenju politike i opštoj ekonomiji, nije iznenađujuće što ima brojnih radova na tu temu. Međutim, većina teorija nastalih do 1960-tih godina bila je zasnovana na premisi (podržanoj empirijskim dokazima) da je visoka nezaposlenost tipično povezana sa

to incorporate lags of inflation, i.e. remove the reliance on purely rational expectations, Gal´ı and Gertler (1999) developed a model that allowed a proportion of firms to use the backward-looking approach to their cost management. Clearly, at present, no model can accurately forecast inflation; hence, the following discussion offers some views on shortcomings of the approaches used thus far to address this critical economic variable.

Discussion

The theories underpinning the above presented inflation models rely the concept of agents' rational expectations and the NAIRU (non-accelerating inflation rate of unemployment), mostly due to the fact that such approach can accommodate stagflation (whereby a high inflation rate is accompanied by a slowdown in economic growth and high unemployment). According to the NAIRU theory, certain levels of unemployment would lead to stable long-term inflation. However, policymakers must make short-term decisions, mostly choosing to reduce the unemployment rate, through expansionary policy. This, in turn, will raise inflation expectations, making the reduction in unemployment only temporary, and leading to even higher inflation in the long term.

Consequently, the expansionary policy ultimately worsens the trade-off between unemployment and inflation, resulting in higher inflation corresponding to each subsequent short-term unemployment rate. Nonetheless, the NAIRU theory implies that there is a 'benchmark' unemployment level below which inflation accelerates, and vice versa. This implies that at NAIRU unemployment level, inflation should remain stable, i.e. neither accelerate nor decelerate.

Moreover, the proponents of rational expectations theory assume that the expected and actual inflation should mostly coincide in practice, allowing for some minor and temporary divergences. Linking this concept to NAIRU, it is evident that it implies that any short-term changes would be confined to very short, virtually non-existent periods. Consequently, any effort to move unemployment levels away from the NAIRU would immediately cause inflationary expectations to shift accordingly, implicitly causing the policy to fail. In other words, any deviations of unemployment levels from the NAIRU would be due to random and transient mistakes in 'rational' expectations pertaining to future inflation rates.

However, towards the end of the 20th century, as the economic conditions changed, it became increasingly apparent that there was no unique and stable NAIRU equilibrium. Thus, given that historically popular inflation models started to fail to fit the actual economic data, both the Phillips curve and the concept of NAIRU had become a subject of debate. This, in turn, raised the questions regarding the validity of rational expectations theory, as it too was based on the premise that there was a predictable, stable and unique equilibrium in the economy.

Clearly, this assumption can no longer be sustained.

Conclusion

Given the importance of inflation and inflation rate forecasts in policy setting and general economy, it is not surprising to find extensive work on this topic. However, most of the theories that emerged prior to 1960s were based on the premise (supported by the empirical evidence) that high unemployment is typically associated with low inflation, and vice versa (leading to the well-known Phillips curve). Underpinning this concept was the evidence of high demand for goods resulting in higher prices, which, in turn, encourages firms to hire more. This would result in a positive feedback, whereby higher employment would raise demand. However, in the 1970s and 1980s, the relationship between inflation became unstable, leading many theorists and practitioners to question Keynesian theories.

In particular, the view was that, when relatively high levels of inflation persisted for several years, this would affect the wage rates, causing overall costs to rise more quickly, thus further increasing inflation. This notion was incorporated into New Keynesian economic models that distinguish between demand-related and cost-driven inflation. Stagflation, in

niskom inflacijom, i obrnuto (vodeći do poznate Filipsove krive). Podršku ovom konceptu dali su podaci o visokoj tražnji za robom koja je rezultirala višim cenama, što je, sa svoje strane, ohrabrivalo firme da više zapošljavaju. To je rezultiralo pozitivnom povratnom reakcijom, gde je viša zaposlenost povećavala tražnju. Međutim, 1970-tih i 1980-tih godina, odnos između inflacije postao je nestabilan, vodeći mnoge teoretičare u praktičare da preispitaju Kejnzijanske teorije.

Konkretno, postojalo je gledište da će, kada relativno visoki nivoi inflacije postoje tokom nekoliko godina, to pogoditi visinu plata, uzrokujući da ukupni troškovi rastu brže, dalje povećavajući inflaciju. Ova ideja je bila inkorporisana u Novo Kejnzijanske ekonomske modele koji prave razliku između inflacije vezane za tražnju i troškovne inflacije. Stagflaciju, po tom gledištu, uzrokuje ova druga i ona se javlja kada se troškovi proizvodnje povećaju zbog promena vladine politike ili nepredviđenih eksternih faktora, kao što je nestašica prirodnih resursa. Mada su ova gledišta solidna, teško je inkorporisati takve neizvesnosti u modele koji mogu da izdrže testove vremena i globalnih ekonomskih uslova koji se ubrzano menjaju. Otuda, može se zaključiti da, sada, nijedan postojeći model ili teorija ne mogu da se koriste za prognoziranje buduće inflacije. Više rada je jasno neophodno i zato postoji nada da će nedavni ekonomski pad, barem, pružiti dovoljno podataka za nove fleksibilne i praktično upotrebljive modele.

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this view, is caused by the latter and it occurs when the costs of production increase due to either changes in government policies, or unforeseen external factors, such as a shortage of natural resources. Although these views are sound, it is difficult to incorporate such uncertainties into models that can withstand the tests of time and rapidly changing global economic conditions. Thus, it can be concluded that, at present, no extant model or theory can be used to forecast future inflation. More work is clearly needed, and it is thus hoped that recent economic downturn will, at least, yield sufficient data for new, more flexible and practically useful models.

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