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INTRODUCTION

Since 1970s majority of countries adopted a mandate of price stability. Monetary authorities rejected developmental initiatives in monetary policy and switched to low inflation and exchange rate stabilization. An inspiration of central banks to move towards monetary frameworks that concern inflation were monetarists, who claimed that monetary policy does not influence real sector variables, so that monetary authorities should worry only about price levels. Economic situation of that period confirmed plausibility of M. Friedman and his colleagues statements. In 1970s leading economies suffered from new phenomenon – stagflation and disinflation was considered to be a good remedy against stagnation in the economy. During next decades central banks tried different tools to stabilize price level: from monetary targeting to direct inflation targeting. Policy aimed to control inflation was successful: consumer prices fall from two digit numbers as of 1980 to 2.4% in 2018.

Despite achieving mostly achieving goal of price stability, during last three decades worldwide economic growth rates has slacked. Scholars propose many explanations: overwhelmingly huge tax burden in developed countries, large level of debt compared with GDP, lack of investments. Economists and policymakers does not have a unique formula how to overcome economic slack, but one of them is linked with monetary policy. After Second World War most central banks were functioning as institutions that complement government policy aimed to create jobs and sound economic growth. Whereas modern central banks are independent and are functioning to keep low inflation and provide macroeconomic stability. However, blind adherence to low inflation can be detrimental, at least in short-term period: higher policy rates can harm real economy by soaring unemployment level and supressing output level. Modern monetary orthodoxy - inflation targeting (IT) except for its benefits has its drawbacks. Countries, which adopted IT often missed their targets, mostly by overshooting, which means that monetary policy was too tight. As a

consequence, monetary policy ex-post appeared to be too restrictive, which had negative consequences on economies.

Central banks became a target of public attention at the beginning of 2020. Covid-19 pandemic showed that both central banks and governments should unify their efforts to overcome huge growth of unemployment and economic downturn.

Relevance of research. Labour market is an important component of real sector. Maximum employment and productivity enhancement are necessary factors of economic growth and development. Global Recession 2008-2009 and ncovid-19 pandemic disclosed that labor market are the most vulnerable economic sphere during huge exogenous shock. In aforementioned circumstances governments and central banks should unify their efforts to cease economic decline, prevent long-term unemployment (hysteresis).

The goal and tasks of the research. The main goal of the research is to examine the link between monetary policy instruments and labour market key indicators. To reach the goal next tasks should be defined and done:

- Analysis of core central bank instruments (discount rate, currency interventions, open market operations and others) and their impact on labour market;
- Applying statistical-econometric toolkit to examine link between financial sector and labour markets;
- Description of pros and cons of alternative monetary frameworks and instruments implemented to magnify employment.

In first chapter are described theoretical aspects of interaction between inflation and unemployment: augmented Phillips curve. Classical relation between inflation and labour market variable is supplemented with introduction of financial sector. Considering the link between monetary policy and unemployment is described impact of core central bank instruments on labour

market, investigated peculiarities of different monetary framework - inflation targeting, monetary targeting, exchange rate anchor.

In second chapter is described the history of central banks' developmental objectives and investigated variables, which have impact on core labour market indicator - unemployment. While performing econometric analysis additionally are built models for developed and developing countries.

In third chapter are analysed alternate central bank frameworks and instruments, which can be adopted to meet labour targets. A list of recommendations is proposed to more profoundly integrate labour market into national monetary policy frameworks.

The object of research is link between labour market and other economic spheres.

The subject of research is interaction between labour market and central bank's monetary policy.

Core empirical and theoretical methods of research are description, induction and deduction, analysis and synthesis and economic-mathematical modeling. To find tendencies amidst different countries core macroeconomic indicators are analyzed.

Information base of the research is primarily compose of scientific articles, policy papers and websites of central banks. Statistics is obtained from World bank development indicators, IMF Annual Report on Exchange Arrangements and Exchange Restrictions, International Labor Organization and Penn World table databases.

This research generalizes the link between monetary policy and labor market indicators. Author unifies and systematizes the impact of core central bank instrument on unemployment, productivity and other labor market marks depending on monetary framework. In research-analytical part author

supplement current econometric research on factors influencing unemployment by incorporating monetary policy frameworks.

Proposals based on experience of other governments and central banks in project-recommendation part can be demonstrated to National bank of Ukraine and national government. Implementation of recommendations would make Ukrainian monetary policy more effective and labor market data and analysis more precise.

CHAPTER I. THEORETICAL PART

1.1 Phillips curve as a fundamental link between labor and financial sectors

From the macroeconomic theory one of the key labor market indicators – the wage depends on 3 main factors, which can be written via (equation 1.1) [54]:

$$W = P_e * F(u, z)$$

where

P_e – expected prices level. The higher the prices the larger will be wages considering desire of workers to bargain;

u – unemployment level. Higher unemployment level diminishes wages because labor supply is much higher than demand;

z – variable composing all other indicators. For example, unemployment benefits.

Considering flexible labor markets employers will adjust product prices to compensate additional wage increase by a mark-up (equation 1.2):

$$P = (1 + m) * W$$

For convenience, let's assume that (equation 1.3):

$$F(u, z) = 1 - \alpha * u + z$$

By putting equations 1.1 and 1.3 into 1.2 we derive (equation 1.4):

$$P = P_e * (1 - \alpha * u + z) * (1 + m)$$

By dividing both parts of previous equation by P_{t-1} we get (equation 1.5):

$$\pi = \pi_e + (m + z) - \alpha * u$$

where

π – inflation rate;

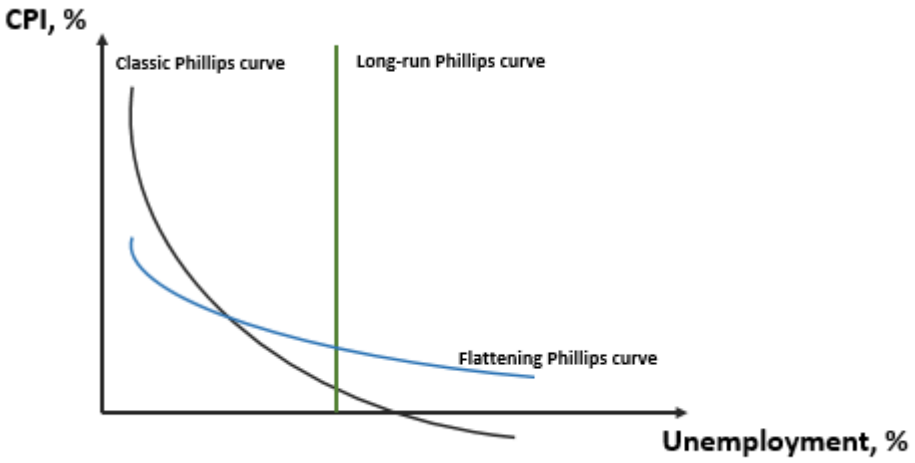
π_e – expected inflation rate.

In economic theory widely used concept is natural rate of employment or non-accelerating inflation rate of unemployment (NAIRU). It is the unemployment rate, when current inflation is equal to expected (Chart 1.1). Thus, (equation 1.6):

$U_n = (m+z)/\alpha;$

By substituting equation 1.6 into 1.5 and accounting for possible shocks v_n we get an equation called Phillips curve:

$\Pi - \Pi^e = -\alpha*(u_t-u_n)+v_n;$



Picture 1.1 Phillips curve

Source: elaborated by author on the base of [20]

Above derived Phillips curve determines the relation between inflation and unemployment. However, inverse relation between these two indicators varies significantly depending on several factors and assumptions.

Now let's turn to the link between inflation dynamics and monetary policy. Changes in inflation are revealed in mark-up shifts that increase nominal numbers of revenues and profits of companies. Rising prices cause decline of real wages. Therefore, employers must increase nominal wages. However, labor costs rise also because of changes in productivity. Considering policy rate as a core instrument of central bank reaction to exogenous inflation shock can be written as proposed by S. Collington [53]: (equation 1.7):

$$\Delta i = \frac{\gamma}{\beta}[\pi_m - (\Delta w - \Delta\lambda)],$$

where

Δi – *policy rate of central bank;*

$\pi_m - inflation\ target;$

$\gamma, \beta - policy\ parameters;$

(Δw - $\Delta\lambda$) – changes in unit labor costs, where $\Delta\lambda$ – changes in productivity, Δw – changes in nominal wages.

According to equation 1.7 central bank should change policy rates, when unit labor costs are deviate from inflation target. By describing the changes in policy rates attention should be paid to degree by which central banks can respond to inflationary pressures. Cooperation between monetary authority and wage bargainers, peculiarities of labor market institutions, level of credibility determine the power of central bank's monetary policy. Considering the level of trust to monetary authority expected future inflation rate can be defined as a sum of target

price level and past inflation weighted for preferences of economic agents (equation 1.8) [53]:

$E(\triangle p_t) = (1-\rho) * \pi_m + \rho * \triangle p_{t-1} + e_t$ *where*

$\triangle p_t$– *actual inflation;*

$\triangle p_{t-1} - past\ inflation;$

$\pi_m - inflation\ target;$

$\rho - weight\ attached\ to\ past\ inflation\ by\ economic\ agent;$

$e_t - error\ term$

By placing equation 1.8 into 1.7 changes in nominal wages can be written as (equation 1.9) [53]:

$\triangle w = \alpha_1[(1-p) * \pi_m + \rho * \triangle p_{t-1}] + \triangle \lambda + \alpha_2 * (u_* - u) + \alpha_3 * \triangle i + e_t,$

where

$\alpha_1 - nominal\ rigidity\ parameter;$

$\alpha_2 - the\ responsiveness\ to\ short\ term\ disequilibrium;$

$\alpha_3 - responsiveness\ of\ wages\ to\ policy\ rates\ changes;$

By inserting equation 1.9 into 1.7 we obtain equation 1.10:

$$\triangle i = \frac{\gamma}{\beta + \alpha_3\gamma}[(1-\alpha_1) * \pi_m + \alpha_1 * \rho * (\pi_m - \triangle p_{t-1}) - \alpha_2 * (u_* - u) - e_t]$$

In equation 1.10 parameters ρ, α_1, α_3 depends on peculiarities of labor market regimes and trust level of economic agents to central bank. Therefore, roughly labour market can be divided into two types: contract and spot. In contract economy

wages are sticky, while in spot one they are nominally flexible. Central banks can be divided into two categories depending on the share of economic agents who assume inflation will be the same as target (forward-looking) or depends previous period (backward-looking). Policy rate rule depending on labor market type and trust to central bank can be written as:

Table 1.1

Interest rates variations under different regimes

	(Contract economy) $\alpha_1 = 0, \alpha_3 < 0$	(Spot economy) $\alpha_1 = 1, \alpha_3 = 0$
Forward looking p=0	$\frac{\gamma}{\beta + \alpha_3 \gamma}[\pi_m - \alpha_2 * (u_* - u)]$	$\frac{\gamma}{\beta}[-\alpha_2 * (u_* - u)]$
Backward looking p=1	$\frac{\gamma}{\beta + \alpha_3 \gamma}[\pi_m - \alpha_2 * (u_* - u)]$	$\frac{\gamma}{\beta}[\pi_m - \Delta\, p_{t-1}) - \alpha_2 * (u_* - u)]$

Source: [53], p.19

Contract economies are characterized by strict nominal rigidities, where labour unit cost are determined by agreed contracts. In these countries Phillips curve is flatter than usual, labor market institutions such as trade unions affect output and employment. If central banks enjoy public trust, then price stability is easier to achieve and keep, while fluctuations in interest rates and unemployment are weak.

Contrary, in spot economies central bank should concern more about situation on labor market. Variability of interest rates and unemployment is higher. When credibility of monetary authority is high, wage bargainers expect inflation to move along target and deviation will cause swings in unemployment. If level of trust to monetary authorities is low, then monetary policy must also react to deviations of inflation from its target.

1.1.1 Shape of Phillips curve

One of the most famous relation in macroeconomics Phillips curve was named in honor of economist W. Phillips, who firstly discovered inverse relation between inflation and unemployment in UK during 1861-1957. Then economist R. Solow and P. Samuelson plotted the same relation in US economy. Both US and UK Classic Phillips curves (Chart 1.1) had consimilar curvature in period of Bretton-Woods monetary system. Strong inverse relationship between inflation and unemployment during decades persuaded many economists that authorities can use its policy instruments to influence one indicator at the expenses of another. However, two future Nobel-Prize winners M. Friedman and E. Phelps argued that Classical Phillips curve describes situation on markets only in the short period. Their key assumptions were abilities of economic agents to include expected inflation in determination of future wages and number of employed.

Phelps and Friedman's inferences were prophetical and in 1970s classical relation between inflation and unemployment became unstable. Explanation is the following: reduction in unemployment led to rise in inflation. However, as inflation grew, real wages of employees declined. Workers required higher compensation that compelled employers to further rise prices and laid off some of them. Therefore, Phillips curve shifted right achieving actually long-run equilibrium.

During next decades relation between inflation and unemployment significantly altered its shape and strength. Theoretical explanation of Phillips curve variety has also expanded. Into core explanation were incorporated market imperfections, rational explanations. Economist R. Gordon subdivided inflation into three parts: demand-pulled or short-term Phillips curve inflation, cost-push and built-in. Such breakdown explains why exogenous factors may have little or no influence on unemployment. [22]

Period of 2nd half of 1980s to 2007 is often called a Great Moderation – an era of low inflation and low volatility of output. Despite been interrupted by Global Recession in 2007-2008 next decade was characterized too by long-term diminishing of inflation and gradual reduction in unemployment around the world.

During last decades Phillips curve has been characterized by lower sensitivity of unemployment to inflation. One of the core explanations of such phenomenon is globalization. Increase of trade to GDP ratio together with faster mobility of labor force between countries enhances opportunities to substitute imports for domestic output. [19]

Another possible explanation is anchoring of inflation expectations. While unemployment fluctuations are remaining to correlate with business cycle and depends on many factors, in majority of countries central banks are obsessed with inflation and stifle large swings.

1.1.2 Factors that determine natural rate of unemployment

Long-run Phillips curve is called non-accelerating inflation rate of unemployment – an equilibrium, when business cycle does not affect unemployment rate. There are plenty of labor market institutions that have impact on labor market. Roughly, countries can be divided into 2 categories; with flexible and tight labor market conditions. Despite such polarity empirical results show that in different countries labor market institutions can show opposite effects on performance oa macroeconomic variables: unemployment, inflation or output growth. In different countries and different time periods labor market institutions can affect volatility or level of unemployment or inflation in different manner. The general consensus from the literature, which can be drawn, is that stricter employment protection legislation have no effect on inflation volatility or output volatility while others find a negative effect on unemployment or output volatility or an inverted U-shaped effect on the relative unemployment to output volatility. [13]

Unemployment insurance

Governments provide unemployment insurance benefits to help their citizens pass the unemployment period. Despite general necessity unemployment benefits can create negative incentives for unemployed to stay in their group as long as possible. Such situation automatically increases natural unemployment rate in the economy and enforces employers to pay higher wages for labor.

Minimum wages

Minimum wage is an artificial instrument of governments, which imposes floor on the level of workers' salary. According to economic theory, setting of wage above the equilibrium rate leads to distortions, when labor supply will be higher than demand. Therefore, some share of workers at least, temporarily will be incapable to find a job.

However, impact of minimum wage is more complex. A commonly used indicator, which measures possible reaction of minimum wage on unemployment is the ratio between minimum and average salary in the country. Additionally, distribution of wages matters: the higher the share of low-skilled workers, the larger will be sensitivity of unemployment to changes in minimum wage.

Bargaining rules

Bargaining rules are additional power tools, which allow workers to require and obtain additional benefits. Primarily, bargaining power is revealed in extension agreements to contracts between employers and employees. Such necessary provisions can be added in countries, where trade unions are significant actors on labor market. As well as direct benefits for employees, strong bargaining position

of workers increases unemployment rate. Enterprises more often hesitate whether to hire or not an extra worker.

Employment protection

Employment protection is a government policy tool aimed to increase for enterprises costs pertain laying-off workers. Generous payments, restrictions on firing of different categories genuinely impedes firms to dismiss their employees, but such rules also decrease incentives to hire. As a consequence, amount of flows between categories of employed and unemployed is diminishing, but unemployment level tends to be higher for a longer time.

Wage indexation

Wage indexation is a process when government manually alters wages of employers to compensate increase in consumer prices. To demonstrate influence of indexation let's assume that x% of wages in the economy is adjusted for current inflation P_t, while (1-x)% is set based on expected inflation P_e. Therefore, Phillips curve can be written as:

$P_t - (x*P_t + (1-x)*P_e) = \alpha*(u_t - u_n)$ *(equation 1.11)*

By assuming that P_e is equal to the prior year inflation P_{t-1} and dividing both parts of equation for (1-x):

$P_t - P_{t-1} = \alpha/(1-x)*(u_t - u_n)$ *(equation 1.12)*

From the above equations we can see that the larger is the share of indexed wages, the stronger is the link between unemployment and inflation. The intuition is straightforward: with wage indexation unemployment reduction leads to inflation, which causes further growth in wages and then, again inflation.

Productivity

Productivity is measured as an output divided by the number of workers who produce good or services. Considering this relation it can be derived that:

%change in employment = % change in output - %change in productivity (eq 1.12) [54];

From this equation we can conclude that productivity affects unemployment positively when it exceeds output growth. However, reality is more complicated.

There are two main reasons why productivity is growing. The first one is technological leap. A new invention or qualitative change in production lead to increase in demand for particular goods or services. As a consequence, to satisfy demand supply should be expanded, what requires both new capital and labor that is favorable for employment.

Second type of productivity growth occurs when current technology of production is improving. For example, automation leads to substitution of workers by machines (downsizing). The result of such reorganization is reduction in workforce.

While in the short-run effect of productivity on unemployment can be ambiguous evidence shows that in middle-run these two indicators show positive relation. The main reason lagged reaction to changes in economy. For example, when productivity growth slowdowns it takes time for workers and authorities to realize that further stable increase in real wages is impossible without reduction in number

of employed. However, in the long-run situation stabilizes. Productivity growth moves in line with real wage upturn without affecting natural unemployment level.

1.1.3 Inaccuracy of unemployment as a key indicator of situation on labor market

Despite being widely used unemployment rate can be imprecise or produce inadequate information about situation on labor market.

Firstly, unemployed are people in labor force, who wants to work, available for it and have actively searched job for last 4 weeks. This indicator does not separate different groups among unemployed. For example, those who stay in that category for longer because of inability to find a job. Another problem is share of non-employed who are not permanently searching for a work, but are ready to switch to employed for the opportunity. [26]

Secondly, in low-income countries to be unemployed is a luxury. People are working to provide subsistence. Losing a job threats to satisfaction of basic human needs. Thus, people are trying to find work as soon as possible or switch to category of self-employed. Another problem is high level of shadow economy. In countries with large informal sector official number of employed and unemployed is distorted because part of both unemployed and non-employed can work in clandestine sector. [3]

Thirdly, in most cases while estimating impact of different variables on unemployment labor participation is assumed as exogenuous factor. However, as Campolmi & Gnocci (2011) showed in some case this labour market indicator is endogenous. It means that depending on business cycle phase and other factors involuntary unemployment can be substituted with voluntary non-employment and conversely and it should not be negligible. [17]

To sum up, effectiveness of monetary policy significantly depends on level of trust to central bank and labor market institutions. Central banks could solely concentrate on price stability when response of unemployment to inflation is low and labor market is characterized by high degree of coordinated bargaining. In countries with flexible labor markets monetary authorities should concern more about situation on labor market, because link between inflation and unemployment is stronger.

1.2 Central bank instruments and their impact on labor market

Nowadays by pursuing price stability as a major monetary objective central banks de-facto adhere to a concept called monetary neutrality, which means autonomous changes in money supply have no impact on real sector variables such as output or employment. However, such strict statement can be fully plausible only in perfectly competitive markets with flexible wages. Acocella et al. (2005) shows that monetary policy affects real economy depending on wage rigidity, competitiveness of market, union centralization. In realistic situations, when firms have some market power, unions can affect wage setting, so that monetary policy has real effects whenever authorities employ a systematic policy rule. While in flexible wage regimes to affect inflation or unemployment wage setting institutions must play role. [23]

1.2.1 Policy rates

Policy or discount rates imposed by Central bank affect employment via clear mechanism. Manual decreasing or increasing of discount rates by authority is a part of loosening or tight monetary policy. These actions affect the costs of short-term borrowing in banking sphere, which influences aggregate demand in the economy. Lower costs of borrowing allow consumers to spend more and entities to borrow

more, spend less on loan servicing and spread their output. Economic revitalization boosts labour demand and unemployment rates are falling. Discount rates raising has opposite effect – in environment of high interest rates job-creating activities are curtailed and for unemployed it is harder to find suitable job for several quarters. But as notes Andolfatto, Hendry and Moran (2002) in long-term employment will increase above its long-term path. [12]

Despite lucid mechanism discount policy channel of influence on labor market can be inefficient or lead to detrimental effects in economy. To have impact on output and labour market variables national financial and banking systems must be developed. Short-term and long-term interest rates should be sensitive to Central bank discount rates alterations.

Empirical results show that unduly changes in policy rates can have long-term negative influence on productivity. Loose monetary policy, when interest rates are kept near zero line for a long time, hampers the cleansing function of the market. Low interest rates decrease borrowing costs for inefficient enterprises allowing them to stay afloat for a long time. Number of entries and exits decline, which adversely impacts productivity growth. This scenario happened in European countries after financial crisis 2008-2009. Borrowing costs reached historical minimums, which allowed many enterprises to continue functioning but aggravated capital allocation efficiency. [35]

Another negative aspect can be positive impact of monetary policy on inequality. Monetary easing can raise inequality by increasing relative share of high-skilled workers. High-skilled share of labour faces smaller matching frictions and is more complementare to capital. [24]

Additional factors should influence decisions to change interest rates when country obeys common monetary policy of any group, for example monetary union. Weak members of such group can suffer greater employment and output declines from external shocks. As a consequence, slack in countries with weaker labour market institutions may bring negative spillovers to other Union members. Therefore,

common monetary authority should pay more attention to business cycle peculiarities.[34]

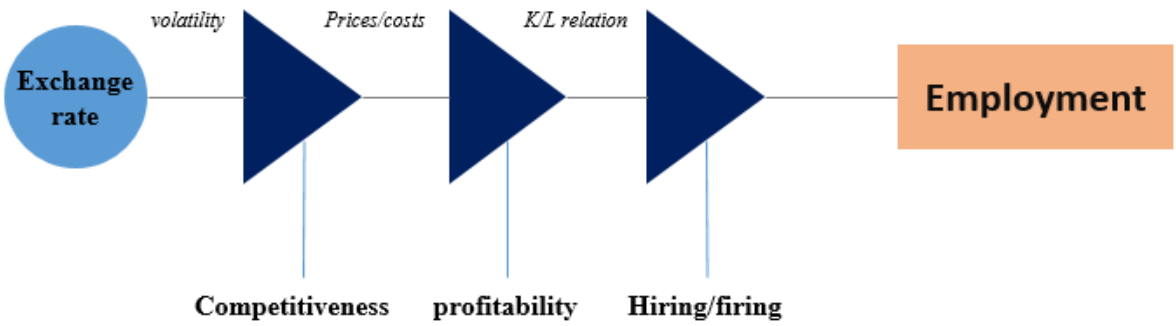
1.2.2 Bank reserve requirements

Nowadays reserve requirements imposed by banks is a supplementary monetary policy tool, which is used rarely. Reduction in bank reserve ratio allows banks to supply more loans to the customers, while its raise cuts the possible volume of loan issuance. Despite clear mechanism, in majority of countries reserve requirements has been remaining stable for years because of unpredictable influence on banking sector. Considering weak utilization by central banks, reserve requirement have minor impact on labour market, especially in countries with weak financial sector.

1.2.3 Currency interventions

Depending on central bank regime and monetary policy framework currency interventions can be used as a main or supportive monetary tool. A key role in a monetary policy currency interventions play when country has any form of exchange rate anchor: crawling pegs, soft pegs, exchange rates within horizontal bands etc. In such countries amounts of interventions are directly tied to movements of exchange rate. In stable and predictive macroeconomic environment currency withdrawals or injections appease market players, anchoring business expectations and indirectly via sound economic growth have favourable impact on employment. However, efforts to freeze hard pegs in a situation of permanent movement of real exchange rates can hamper tradable sectors of national economies. Severe appreciation of national currency reduces competitiveness of exporters, squeezes their profits, which can deteriorate performance of separate sectors, and, as consequence, decline in a number of employed. Negative influence of currency interventions or their absence on employment can happen when

currency shock takes place. Enforced devaluation of currency decreases purchase power, inflates prices of imports and simultaneously increases costs compelling producers to increase prices. Lower demand for goods & services caused fall of production, closure of enterprise and unemployment.



Picture 1.2. Channel of currency exchange impact on employment

Source: Author`s own compilation

Central banks under other monetary frameworks utilize currency interventions as a secondary tool. Under monetary targeting, central banks are trying to impose floating exchange rate and minimize the influence of the currency channel on intermediate objective, primarily money supply. [36]

Central bank`s adoption of inflation targeting assigns a supplementary role to exchange interventions in achieving price stability. Authority usually acts on foreign exchange market to smooth volatility or nigh target. Reduction of exchange rates magnitude is favorable for labor market because entities have more time to adjust their prices and costs to prevent output declines. Severe depreciation or appreciation of national currency as in the case of primary tool may be unfavorable for employment in separate sectors.

Labor market institutions and openness to trade are two crucial factors that determine how level of exchange rate volatility influences labor market. Obviously, larger outflows and inflows on exchange indicates about deeper rooting into global

value chains. On inflexible labor markets, where employees have enough bargaining power and trade unions are weak, currency shocks may lead to higher unemployment levels. Enterprises cannot adjust their wages to new conditions and are compelled to fire workers. [37]

1.2.4 Communications

During last decades functioning of central banks has become more open to the public. A global trend to independence and transparency of monetary authority, development of financial markets and spread of mass-media encourage central banks to communicate their actions and intentions.

Central banks proclaim their actions to:

- achieve or hold their target. Achievement of goals fixed in mandate require alterations in behaviour of economic agents, who must be informed about central bank's actions;
- shape household, firms and other agents' expectations;
- change short-term financial market indicators. To pursue financial stability CBs often intervene by supplying liquidity or changing short-term interest rates;
- Raise predictability of macroeconomic environment and improve forecasting accuracy;
- switch real actions in achieving targets.

A quantitative assessment of Australian, American and UK communication made by ILO showed that in their notes monetary authorities regularly mention words tied to real sector of economy and labour market. Frequency of those statements does not depend on mandate of Central bank: dual one or an explicit/implicit inflation target. Conversely, it depends more on business cycle and global financial conditions. For example, aftermath 2008-2009 crisis Central banks put more emphasis on financial stability. [38]

Considering aforementioned communication purposes, Central banks despite its legal mandate impacts labour market. Indirectly, labour market participants and experts may shape their expectations based on notes about monetary conditions, financial stability, external conditions, economic growth and labour or social issues.

1.2.5 Open market operations (+QE)

Open market operations (OMO) is one of the core monetary tools, which is used to manipulate short-term interest rates in the economy. To achieve this goal monetary authority buys and sells securities or imposes interest on reserves (IOR). To reduce interest rates central bank buys bonds, therefore providing additional liquidity to the market. Per se increase in money supply drops the yield of government bonds and decreases interest rates. Bond selling is directed towards short-term interest-rate growth.

Interest on reserves is relatively new monetary imposed as a handle to contract or facilitate bank lending. Central banks oblige commercial banks to hold determined share of their liabilities in its vault. By requiring price of this service banks must hold additional funds to pay interest on their reserves. Thus, by altering level of IOR Central bank can impact amount of lending available to commercial banks.

Classical open market operations influences real sector via banking system. But as well reserve ratio tool, their influence largely depends on financial sector development.

Quantitative easing (QE)

QE is a relatively new exceptional monetary instrument. It is an open market instrument when central bank voluntarily increases money supply by injecting billions of currency units through repurchase of government bonds or other securities on the market. Large inflows of currency increases market liquidity and leads to better ability of financial sector to execute its intermediary role.

QE was firstly implemented to boost economic activity in Japan in the 1980s. [39] Despite even earlier theoretical applications, modern QE policy appeared as a respond to 2008-2009 Global recession. In the environment of low interest rates, high unemployment, low inflation and weak economic recovery traditional further loosening of monetary policy was ineffective. Central banks no longer were able to cut policy rates, while economies were found themselves in liquidity trap. Successively, Federal Reserve, Bank of England, ECB, Sveriges Riksbank launched QE program in their countries by repurchasing specific assets such as Treasury notes and mortgage-backed securities in US, gilts in UK.

Reduction of unemployment and hysteresis effect overcoming were among QE goals, but it influences labour market via several channels [41]:

- *Credit channel*

  By increasing banking system liquidity, banks and other financial institutions are able to provide more funds to real sector, which can boost economic activity, which leads to employment growth and new workplaces creation.
- *Exchange rate.* QE implementation leads to interest rates decline and increase in money supply, which, according to covered parity theory, causes currency devaluation. Smooth devaluation of national currency can bring benefits to labour market by increasing competitiveness of national economy.
- *Signalling effect.* QE implementation is highlighted in mass-media, which ensures key market players that regulator will take necessary actions to support economic recovery.
- *Fiscal effect.* In some cases QE policy decreases interest-rates that makes government borrowings cheaper. Lower cost of debt allows governments to spend less on debt service and redistribute government expenses into alternative projects.

Theoretically, implementation of QE can be considered as an extention to central bank market operations. However, spontaneous appearance to solve ad hoc economic issues obliges to analyse QE from the side of its effectiveness in

overcoming obstacles. Despite huge criticism QE partly achieved its goals: since 2010 unemployment rates in both EU and US declined from ~10% to 4-5%, while GDP growth also recovered. But exit from the crisis cannot be attributed solely to QE, US and EU countries used widely fiscal policy too. Moreover, QE attributes to severe reduction in interest rates, which can be reason of low productivity growth aftermath of the 2008-2009 crisis.

1.2.6 Coordination with fiscal authorities

Every country considering its objectives and policy frameworks carries out both fiscal and monetary policy. Mutual influence of their interaction on the overall economy varies depending on the level of central bank independence:

Independent Central bank

Inability of government to impact decisionss made by monetary authorities means that government body responsible for fiscal policy (primarily Ministry of Finance or alike institution) can only adjust its actions to ad hoc decisions of monetary authority. According to macroeconomic theory, considering the business cycle phase both monetary and fiscal authorities can implement expansionary, contractionary and neutral policy. At particular time period each combination of aforementioned types affect in different ways key macroeconomic variables. Bennet and Loayza (2002) developed a simple matrix 2x2 matrix with outcomes and payoffs (Table 1) received by both monetary and fiscal authority referring to type of their policy – contractive or expansive [40]:

Table 1.2

Interaction of fiscal and monetary policy

	Tight monetary policy	**Relaxed monetary policy**
Tight fiscal policy	Outcome: Low inflation Less employment Payoff: Central bank: 6+1=7 Fiscal authorities: 3+1=4	Outcome: Moderate inflation Moderate employment Payoff: Central bank: 4+2=6 Fiscal authorities: 2+4=6
Relaxed fiscal policy	Outcome: Moderate inflation Moderate employment Payoff: Central bank: 4+2=6 Fiscal authorities: 2+4=6	Outcome: High inflation Strong employment Payoff: Central bank: 1+3=4 Fiscal authorities: 1+6=7

Source: [40]

Considering matrix above modern central banks with price stability mandate will be trying to achieve low or moderate levels of inflation. So that, arrangement of fiscal and monetary authorities or prevailing fiscal rules will have impact on employment level, output, savings and investments. By pursuing their own goals by ignoring the arguments of the other side financial instability can take place. For example, long-run inconsistency between central bank and government under conditions of lax fiscal policy can lead to tightening of monetary policy, which in the future would respond in larger fiscal imbalance.

Dependent/Coordinated Central bank

If monetary authority actions depends on the orders from the above, then central bank should use its instruments to directly amplify fiscal policy and give some recommendations or standards for government bodies, entities. Under such circumstances except for business cycle, macroeconomic conditions of country depend on reasonableness of government policy. If ministry of finance does not carry out too soft fiscal policy, reinforced by loosening monetary policy, economy will be developing in line with business cycle and, probably, suffer mediocre losses in period of slowdowns. Albeit, if authorities want voters like too much by soaring government expenses to achieve maximum employment and economic growth,

economy will pass through hard lending, which happened a lot of times in developing countries (Ukraine, Argentina, Brazil, Venezuela, Peru).

Coordination means that both central bank and government make common effort in carrying out economic policy. They set together macroeconomic objectives, participate in each other committees, develop institutions (secondary securities market) and implement reforms (financial liberalization) that will make both monetary & fiscal policy more effective. [42]

Despite close cooperation, while coordinating with each other central bank and government impose barriers to prevent misapplications. Central bank should hold operational autonomy, while body responsible for fiscal policy is forbidden to borrow from central bank on primary market.

Concerning developmental objectives coordination between monetary and fiscal looks the most favorable option. Joint set of targets, modelling, policymaking reaction to threats can protect country from shocks and provide macroeconomic stability.

1.2.7 Financial market restrictions on trade, settlement and (interest rates ceilings & floors, capital and currency constraints)

Depending on the level of liberalization each country has a short/long list of restrictions aimed to provide macroeconomic stability or boost development of selected industries. Besides traditional restrictions on trade (quotas, customs duties, licences), exchange taxes & subsidies, monetary authorities imposes restrictions, which generally complicates interactions among economic agents both within and between countries. Such measures exist to prevent money-laundering, fraudulence in banking sphere, large outflows of capital.

Myopic analysis indicates that any restraints that slowdowns the capital flow, leads to lower output and, as a consequence, employment rates. However, with unquestioning benefits of liberalization level of risk increases too. In employment

sphere influence of establishing/cancellation of restrictions is not directly straightforward and hardly measurable.

1.3 Peculiarities of central bank frameworks and labour market

Depending on monetary regimse central bank have limited scope of instruments to directly/indirectly influence labour market variables. In this section will be described features of Central banks' regimes influence on labour market and their effectiveness.

1.3.1 Inflation targeting (IT)

IT is a monetary regime, when central bank directs its key tool – policy rate – to achieve stable long-term rate of inflation. Inflation objective is primarily measured via CPI on annual basis. Generally, paying attention to price stability compels central banks to neglect or put aside other macroeconomic objectives. However, IT has strong positive effect on labour market.

Firstly, it eliminates distortions, caused by high-inflation: unstable purchasing power of the currency, bankruptcies and huge number of workers discharges.

Secondly, long-term low and stable inflation raise the level of certainty in the economy. Employers and employees gain confidence about future and can more easily arrange about wages and compensations. Absence of large price swings facilitates investments. Both external and internal investors are able to make long-term decisions and calculate more precisely the benefits of projects.

Thirdly, smoothing swings in currency exchange market to keep inflation rate in bounds prevent losses of enterprises' competitiveness in tradable sector.

Fourthly, if IT leads to stabilization of economy, then maximization of welfare can be achieved. In low inflation environment all income groups can keep their purchasing stability and do not suffer losses from shocks. [24]

However, considering inverse relation between inflation and unemployment, at least, in short-run, excessive obsession on achieving stable inflation levels can be detrimental

for employment. In times of financial crisis to maintain inflation on stable level central bank raises policy rates, which can increase unemployment levels. Conversely, during the period of economic boom monetary authorities do not allow discount rates come down enough to nigh natural unemployment levels.

1.3.2 Monetary targeting

Monetary targeting is a monetary policy framework, when Central bank chooses one of monetary aggregates (for example, M2 or M3) as an intermediary target. By imposing concrete middle-term value or bands for money supply variable central banks try to achieve one or several objectives: price stability, nominal GDP growth or others.

Monetary targeting is based on well-known Fischer equation:

$M*V=P*Q$,

where

M - money supply;

V – money velocity;

P – prices of goods & services;

Q – quantity of produced goods & services

According to Fischer equation central bank by manipulating money supply impacts price and output levels (Chart xx). By implementing monetary policy under monetary targeting central bank regard money demand and therefore velocity to be relatively stable.

Picture1.3 Quantity theory of money mechanism

Source: elaborated by author on the base of [67]

Monetary targeting became popular in 1970s – period of stagflation: monetarists' affirmations that inflation is a monetary phenomenon were heard. Central banks started to control money supply in order to target price levels. However, 20 years of widespread experiencing proved ineffectiveness of monetary targeting. Monetary targeting adopters still faced inflation spikes, while adjustments to monetary rules did not solve these problems. Rapid development of stock market, financial and payment innovations, changeful money demand made link between money supply and economy less predictable. Thus, central banks started to reject from monetary targeting by more widely utilizing new policy tools or switching to new policy frameworks such as IT.

Considering weak relationship between money supply and GDP or inflation, link with labour market seems to be even less clear. Basically, central bank can change money supply to implement tight or loose monetary policy. Increase in money supply will increase aggregate demand, spending in economy and then reduce unemployment. While money sterilization can increase unemployment level.

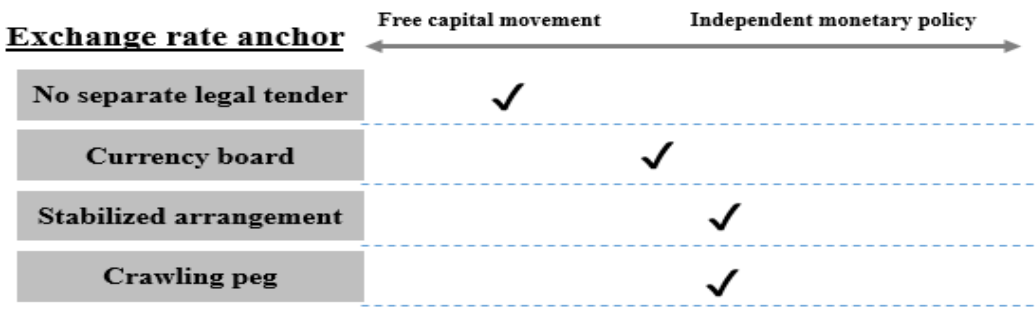
1.3.3 Fixed exchange rate

Pegged exchange rate or fixed exchange anchor is the most widely used monetary framework in the world, when country fixes its currency to another foreign currency, basket of currencies or commodity, for example, gold.

From 10 exchange rate regimes defined by IMF 5 can be considered as separate monetary policy regimes:

- No separate legal tender;
- Currency board;
- Stabilized arrangement;
- Crawling peg;
- Other

International economy is based on the theory of impossible trinity: inability of country to hold simultaneously fixed exchange rate, independent monetary policy and free capital movement. Taking into account this restrictions countries with different types of monetary regimes must adhere to either free capital movement or independent monetary policy (Chart 1.3).



Picture 1.4. Interaction between exchange rate regimes and financial policy

Sources: IMF Annual Report on Exchange Arrangements and Exchange Restrictions 2018, own calculations

Each pair of exchange rate anchor and financial policy type has its peculiarities in carrying out monetary policy. Therefore, impact of monetary policy on labour market will be different.

Under no *separate legal tender* foreign currency circulates as the sole legal tender, which implies that central bank is deprived from monetary policy fulfilment. Thus, only fiscal authorities can consciously carry out policy to affect labour market. In some cases, countries with no legal tender are members of monetary union. For example, European Central Bank (ECB) implements common monetary policy for 19 countries.

Therefore, actions of common monetary authority affects differently both real and monetary variables of its members.

Currency board is a regime, when domestic currency is fully backed by foreign assets and is fixed. Central bank does not fulfil the roles of the lender of last resort. Thus, scope of monetary policy is quite limited: primarily supervision function can be executed to the full extent.

Stabilized arrangement and crawling peg are more flexible fixed rate anchor regimes. Central banks have option to choose between free capital movement and independent monetary policy. Under these exchange rate anchor regimes the most powerful channel of influence on labour market is actually exchange rate changes – devaluation and revaluation. Selection of independent monetary policy allows Central bank to utilize set of monetary tools, which are available for other types of monetary regimes. While choosing free capital movement to prevent negative consequences of rapid capital inflows or outflows, central bank can smoothly adjust exchange rate to equilibrium level.

Compared with pure IT exchange rate anchor can negatively affect consumption of households in tradable sector because of volatility. [25]

Conclusions to the Chapter I

Phillips curve remains a core macroeconomic equation that unifies labour market and financial sector of the economy despite its different shape between countries and through time. Macroeconomic theory shows that there are different channels via which monetary policy affects labour market indicators. Discount rates and open markets operations partly determine cost of capital for enterprises and incentives to substitute consumption by savings of economic agents. Currency interventions have direct influence on competitiveness of enterprises in tradable sector. Nowadays, central banks also affect business expectations via communication with the public: by sharing press-releases, briefings etc.

However, tightness of central banks' impact on labour sector depends on several factors. Higher sensitivity of real sector variables to monetary policy instruments determines success or failure of central bank interventions. Except for material factors, the degree of monetary policy impact on labour market depends also on one methodological aspect – precision of core labor market indicators: natural and actual unemployment, labor force participation, shadow employment. Classical unemployment index has several drawbacks: i) it ignores the movements within the unemployed; ii) it can be meaningless in countries with large informal sector that can explain low determination of monetary and non-monetary factors derived in research-analytical part. While natural unemployment despite durable theoretical basis in reality is unobservable variable and empirical investigations showed that ex post estimations can significantly vary compared with ex ante calculations.

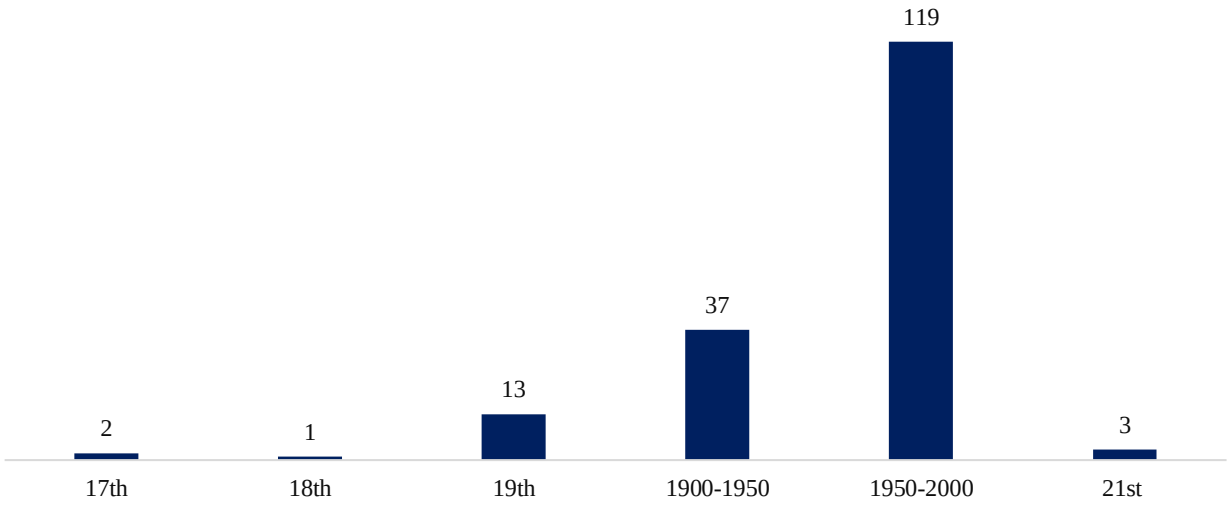
CHAPTER II. INVESTIGATION OF CENTRAL BANK'S DEVELOPMENTAL INITIATIVES AND EXAMINATION OF CORE MONETARY INSTRUMENTS IMPACT ON UNEMPLOYMENT

According to theoretical findings, there is a link between labour market and financial sector. Central banks as authorities, which carry out monetary policy, can influence real sector via several channels. However, both monetary policy and central banking are not freezed and are evolving over time. In this chapter will be described a history of centrals and their role in promoting developmental targets, particularly employment and output growth. Additional emphasis is put on the Federal Reserve – the most well-known central that has dual mandate – maximum employment and stable prices.
Besides actually considering central banks as agents of employment growth, in this chapter will be examined the link between monetary variables and their impact on a key labour market indicator – unemployment.

2.1 The history of Central banks and their developmental role

The history of central banking prior to 1940s

Functioning of central banks dates back to 17th century. First central banks were established in Sweden – Riksbank (1668) and England - Bank of England (1694) to provide funds to the government. In next 2 centuries 14 (Chart 2.1) central banks appeared in majority of most developed countries of that epoch: France, Russian Empire, Austro-Hungarian Empire and others. [60] However, as well as Riksbank and Bank of England, they financed expenses of authority, but they had also become a lenders of last resort by conducting operations with commercial banks. Despite official absence of developmental objectives central banks started to intervene during financial crises, which periodically took place since 1825.



Picture 2.1 Number of established central banks

Source: [60], p.3

Central banking in 20th century

New wave of central bank establishment took place after World War I. During military conflict countries left the gold standard to finance soared military expenses. Abandonment of ordinary monetary regime required new independent countries to delegate functions of banknotes issuance, lender of last resort and banking supervision to central banks.

In 1920s central banks followed 2 main purposes: overcome consequences of World War I and renew the gold standard parity. Some central banks raised policy rates to reduce inflation, which led to deflation. Others launched new policy instruments, for example, open market operations and proliferated the range of their functions, incorporating lender of last resort and banking supervision.

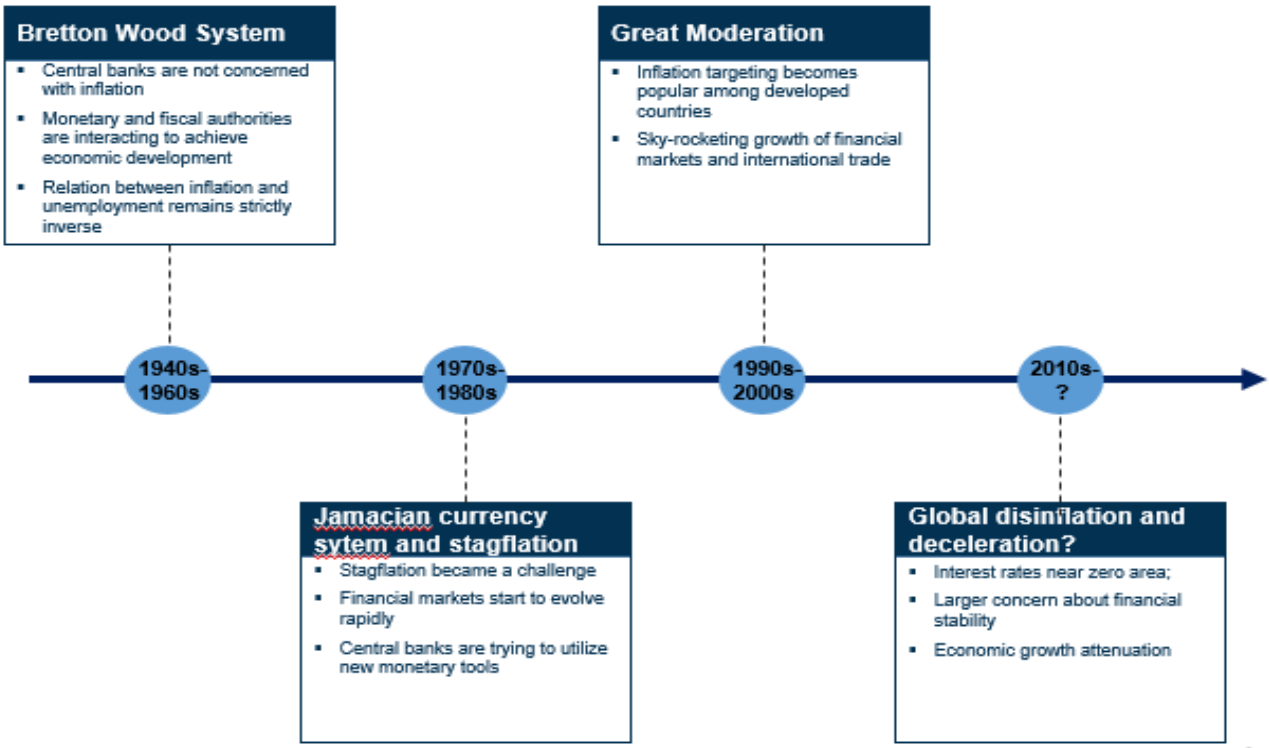
In 1930s both government and central banks primarily build their policy on reaction to the Great Depression by executing countercyclical policy. Majority of developed countries during 1930s again left gold standard because of inability to control gold parity on previous levels.

A trend towards pursuing developmental initiatives began after World War II. Considering need to recover under new Bretton-Woods monetary system countries

started to develop their economies. A key reason of such reorientation was a necessity to recover world economies and to industrialize low-income countries. Governments of both developed and developing countries launched programs aimed to promote targeted sectors, create workplaces, while monetary authorities supplemented these efforts. In majority of cases central banks were accountable to the government. In different countries monetary authorities imposed restrictions on capital flows to promote national production, supported commercial lending and developmental banks, controlled interest rates.

In 1970s economies faced with one common global challenge – stagflation. Abandonment of Bretton Woods system, introduction of new Jamacian financial system with fiat money led to faster growth of money supply around the world. Coincided with economic recession leading economies shifted their efforts to overcome stagflation. Since 1970s price stability gradually became a major concern of central banks around the world. Firstly, they are starting to control money supply – a recipe prescripted by monetarists, then, considering instability of monetary targeting – more widely utilized exchange rate anchoring or policy rate manipulations. While putting more emphasis on inflation evolved a trend towards independence of monetary authority from fiscal one. Two reasons explain why central banks since 1980s started massively move away from cooperation with government: neutrality of monetary policy and temptation of government to control money issuance.

Period from the mid 1980s to 2007 is called Great Moderation in economic history. For 25 years despite several regional crises world economy showed stable rates of output growth and relatively low volatility of key macroeconomic indicators. During this period more central banks adhered to neo-liberal approach: departure from developmental objectives to price stability and central bank independence. Since 1990s 41 country adopted inflation targeting regime (IT), while others to provide price stability continued to anchor their exchange rate. Even countries such as Asian Tigers or Brazil, who had been following developmental initiatives and concerned about employment during previous decades partly reoriented to price stability.



Picture 2.2 Peculiarities of Post Second World War monetary systems

Source: author's own conclusions

Global recession that occurred in 2008-2009 not only compelled central banks to react proactively to new challenges. Together with launching new instruments such as quantitative easing, close supervision over banking system several countries revised mandates of Central banks. Considering the basis of the crisis – fragility of the banking system – the share of counties in CBLD – IMF central bank legislation database with price stability objectives after 2014 has declined among all income groups – from low-income to high-income. Such wane was primarily compensated by increase in share of monetary regimes named price stability subsidiary macro objectives. Fraction of countries with price stability alongside other macro objectives remained approximately the same.

To sum up, majority of modern central banks do not concern about employment directly. During recent decades monetary authorities have reoriented towards low inflation and financial stability, leaving majority of developmental objectives: employment creation, output growth etc. However, there are several central bank that

among their macroeconomic targets have maximum employment. The most famous among them is the US monetary authority – the Federal Reserve System.

Case study Dual mandate of Federal Reserve System [30]

In the 2nd half of 1800s in the US happened 3 banking and economic crises: in 1873, 1893 and 1907. To protect economy against looming new crisis Senate drafted several Acts and finally on December 23, 1913 president W. Wilson signed The Federal Reserve Act. The Federal Reserve System was created to "provide for the establishment of Federal reserve banks, to furnish an elastic currency, to afford means of rediscounting commercial paper, to establish a more effective supervision of banking in the United States, and for other purposes".[61]

Up to the end of World War II Federal Reserve did not concern about employment. During World War I Fed supported military expenses, while in 1920s central bank facilitated promotion of US trade and banking foreign lending. Since 1920s Fed started to fulfil open market operations and active usage of discount rate to boost economic growth.

In 1929 Federal reserve along with other central banks faced Great Depression without sufficient preparation. Despite raising discount rates in 1928-1929 to cool down speculative boom, during large economic slowdown Fed was quite passive and made several rude mistakes. Firstly, Federal Reserve raises interest rates in the Fall of 1931. Growth of interest rates can be justified in periods of high inflation to cut recover price stability, but high nominal interest rates in times of deflation only further smashes real and banking sector. Secondly, Fed did not react to 30% reduction in money supply. Great Depression in US was characterized by huge fall in aggregate demand, therefore enterprises laid off millions of workers and there were simply not enough "money bills". Thirdly, Fed did not execute its function of the lender of last resort. During 1930s crisis banks suffered huge losses and

liquidity problems and ~5000 of them bankrupted, while Fed did not supported them.

Catastrophic consequences of Great Depression remained for a long time in consciousness of American people. Thus, after World War II Congress passed the Employment Act, where was clearly stated "The Congress hereby declares that it is the continuing policy and responsibility of the Federal Government to promote maximum employment, production, and purchasing power". During 1950-1960s US central bank had been promoting objectives clipped in the Employment Act, while price stability was provided under Bretton- Woods system.

Since 1970s global macroeconomic conditions changed dramatically: US dollar was decidedly untied from gold, classical Phillips curve ceased to work, oil price shocks shaked inflation rates. Leading central banks had to react to new macroeconomic phenomenon – stagflation: high unemployment & high inflation levels. A fight against stagflation was composed of money targeting elements introduction, legislative clipping of dual mandate with further strict disinflation policy.

In the beginning of 1970s Federal Reserve System concerned with menace of inflation decided to target money growth. [31] Fed defined weekly paths for M1 and indicated behaviour for M2. However, in the end of 1970s Fed started to miss its money aggregates targets and, consequently, gradually quited monetary targeting. Formally, Federal Reserve left monetary targeting in 1987 Fed when it rejected to set further targets.

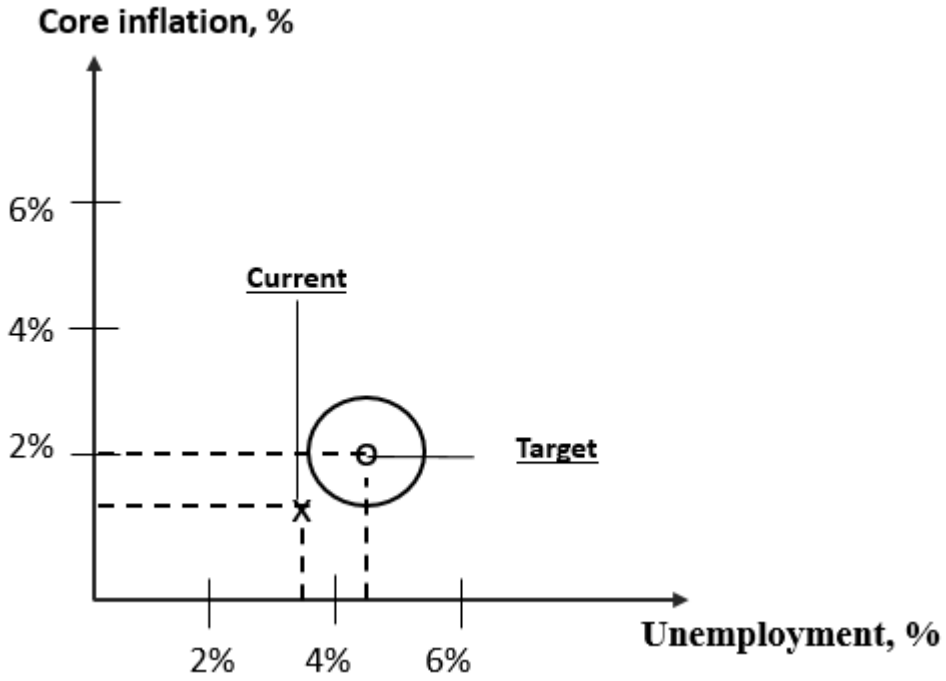
Since 1977 US central bank according to The Federal Reserve Reform Act of 1977 started to functioning to "promote maximum employment, production, and price stability". New amendments to legislation about Federal Reserve were made considering 2-digit rise of annual CPI and unemployment surpassing 7% level. New Fed Chairman Paul Volcker by gauging between two objectives low inflation and low unemployment decided that price stability should be achieved in the first place. In 1979 Federal Reserve started strict disinflation policy by raising short-

term interest rates. During next few years Fed finally achieved 5% inflation and then unemployment rates began movement towards natural level.

During Great Moderation US did not face macroeconomic challenges compared with Great Depression or stagflation. Fed reacted to any serious problems such as Middle East crisis in the beginning of 1990s or Dot-com bubble in 2000 and held low inflation and unemployment levels.

A Global Recession of 2007-2008 caused the largest output decline and unemployment rise since the period of Great Depression, which required active interventions of both monetary and fiscal authorities. To fight against crisis Federal Reserve cut discount rate from 5.5% to 0.25% and started to repurchase from the market government bonds and mortgage-backed securities. In 2010s after recovery American economy showed quite modest performance: unemployment reduced to natural level too slowly, while GDP growth did not outreach 3%. Thus, since 2007-2008 crisis Federal Reserve has launched 3 waves of QE.

Since 2012 main monetary policymaking body of Federal Reserve the Federal Open Market Committee (FOMC) explicitly defined CPI of 2% as price stability target. (Chart 2.3). This 2% target should be held, considering undershoot or overshoot both equally undesirable. Unlike inflation unemployment target – natural rate – is variable and alters periodically due to technological progress and structural changes in the economy. In the beginning of 2020 natural rate of unemployment calculated by Federal Reserve was 4-4.5%. [32]



Picture 2.3. Unemployment and inflation in United States

Sources: based on [63], [64], [65].

In March 2020 Federal Reserve performed the largest interventions since Global Recession because of coronavirus (covid-19) lightning-fast proliferation. On March 15, 2020 Federal Reserve cut interest rate from 1.75% to 0.25% and started to buy bonds "in the amounts needed" to protect economy against new depression. [62]

2.2 Factors that influencing the dynamics of unemployment

2.2.1 Theoretical methodology

In theoretical part was described that central banks are influencing labor market via their core instruments: policy rate, exchange rate, open market operations and others, which are transmitting on key macroeconomic variables such as output growth and inflation. However, even the most persistent connection between labor and financial markets called Phillips curve shows that stable inverse relation between inflation and unemployment holds only in the short run and varies as decades elapse. Empirical evidence from EU-countries, United States and other countries showed that non-monetary factors such as social benefits, bargaining power, power of trade unions determine the rate of natural unemployment and volatility of its actual level.

In this study will be examined the impact of core monetary and non-monetary indicators on unemployment. A sample consists of 43 countries (Annex I) with a GDP at current prices exceeding $5 bn in every year during 2000-2017. A time range 2000-2017 is selected because since the beginning of 3rd millennium Frazer Institute calculates Economic Freedom index, which includes labor market indicators.

Except for the core model, 2 additional models are simulated, where countries are distributed based on the level of their development: developing and developed. A model with a few emerging countries is not composed, because of lack of observations.

Considering countries peculiarities we assume that each country has some form of heterogeneity. So that, balanced panel regression with fixed effects is the best option. Additionally each model is tested for endogeneity and presence of random effects. The equation of the models can be written as:

$$unemp_tot_{it} = \alpha_i + cpi_{it} + reer_2010_{it} + fcep_{it} + real_int_rate_{it}$$

$$+lab_mark_regul_ief_{it} + u_i + e_{it};$$

where

α_i – individual fixed effects of each country in the sample;

unemp_tot – a total share of labor force that is without work but available for and seeking a job. This indicator is a core labor market indicator shared by International labor organization.

cpi – consumption price index based on World bank data. As empirically examined, this regressor is expected to inversely affect unemployment in the short-run;

reer_2010 – real effective exchange rate in prices of 2010 calculated by the World Bank. It is assumed optimal when *reer* is not deviating from long-term path significantly;

fcep – annual private final consumer expenditures growth. In phase of economic growth consumer spendings are rising along with increase in sales that is accompanied by creation of new workplaces and reduction in unemployment. Private consumer expenditures are separated from government because I assume that governments are less prone to fire workers in period of economic turmoil than private entities.

real_int_rate – real interest rate shared by the World Bank. From the theoretical side, ex ante the relation between real interest rate and unemployment is not clear. Low nominal and real interest rates accompany loosening monetary policy, which leads to higher output and lower unemployment. However, high real interest rates can remain high through the business cycle because of tight monetary policy or high risks;

lab_mark_regul_ief– labor market regulation pillar of Economic Freedom Index proposed by Frazer Institute. [66] It is a complex sub-indicator measuring the level of labor market tightness in particular country. Labor market regulations pillar consists of 6 sub-pillar:

1) *Hiring regulations and minimum wage.*
2) *Hiring and firing regulations;*
3) *Centralized collective bargaining;*

4) *Hours regulations;*
5) *Mandated cost of worker dismissal;*
6) *Conscription*

The higher is the value of this variable the more flexible is labor market. Each labor market regulations subpillar affects the decisions of employers to hire or fire additional workers, so that the relation with unemployment is expected to be inverse.

gfcf – annual growth of fixed capital formation or capital expenditures shared by World Bank. This indicator is echoed to the share of earnings that private enterprises and government spend to buy fixed assets for long-term economic benefits. If an entity spends more financial resources on capital, then propensity to substitute labor with capital and therefore unemployment will be higher.

u_i - individual heterogeneity of countries;

e_{it} – idiosyncratic error-term.

2.2.2 Results

Model 1

Model 1 embraced a full dataset of 43 countries. It confirms core assumptions of the model. All regressors, except *gfcf* are significant at least at 10% confidence level in model with standard errors. Real interest rate positively affects unemployment, annual inflation as embedded in Phillips curve shows negative short-term relation with unemployment, growth in private consumer expenditure proves negative impact of better economic performance on unemployment. Composite index of labour market regulations corroborates that highly flexible stronger market forces facilitate lower unemployment.

Curious is impact of *reer_2010* variable on unemployment. The higher is the appreciation of national currency, the lower is the unemployment level. From the first glance, it is counterintuitive because severe revaluation undermines the

competitiveness of the tradable sector and leads to higher unemployment. However, long-term appreciation can accompany economic growth and significant reduction of real effective exchange rate occurs when countries are forcibly devaluing currencies to mitigate the consequences of the crisis or recover competitiveness.

Gross fixed capital formation growth variable shows predictable sign but is not significant.

Despite F-test shows that H_0 can be rejected and all coefficients are not equal to 0, coefficients of determination are low (<0.1). It means that variance of unemployment is poorly predictable by independent variables. In augmented model with robust-standard errors all coefficient except for *fcep* are insignificant. Hausman and Breusch-Pagan tests shows that all variables are exogenous and difference in coefficients between random and fixed effects model are insignificant.

Table 2.1

Results of panel regression based on model 1

Number of observations	649				
Number of observation groups	43				
F-statistics (6,600)	10.37				
Prob>F	0.00				
F-statistics (all u_i= 0) (6,600)	59.49				
Prob>F	0.00				
R^2					
within	0.094				
between	0.0861				
overall	0.0794				
corr (u_i,Xb)	0.0338				

unemp_tot	Coef.	Std. err	Cluster-st.d robust errors	P>|t|	P>|t|, robust
real_int_rate	0.05887	0.01535	0.03524	0.000	0.102
cpi	-0.0389	0.0223	0.02548	0.081	0.134
fcep	-0.13	0.0349	0.05108	0.000	0.015
reer_2010	-0.0263	0.0081	0.01723	0.001	0.134
lab_mark_regul_ief	-0.5856	0.1807858	0.3767	0.001	0.128
gfcf	0.016389	0.01133	0.00934	0.149	0.087
_cons	13.9575	1.3869	2.551684	0.000	0.000

Table 2.2

Testing for random effects of panel regression in model 1

Test name	Chi2 statistics	P>Xi_2
Hausman test	4.22	0.6466
Breusch-Pagan test	3231.77	0.000

Model 2

Model 2 has the same specification as model 1. The results are consimilar. All regressors show the same sign, F-test, Hausman and Breusch-Pagan tests give the same conclusions. However, *gfcf* variable is significant and all three R-squared coefficients are much larger. Better explanation of unemployment variation by set of independent

variables means that link between labour and financial sector are stricter and, probably, unemployment coefficient is more precise variable in developed countries.

Table 2.3

Results of panel regression based on model 2

Number of observations	277				
Number of observation groups	17				
F-statistics (6,600)	10.13				
Prob>F	0.00				
F-statistics (all u_i= 0) (6,600)	23.59				
Prob>F	0.00				
R^2					
within	0.193				
between	0.4432				
overall	0.3376				
corr (u_i,Xb)	0.3178				
unemp_tot	Coef.	Std. err	Cluster-st.d robust errors	P>|t|	P>|t|, robust
real_int_rate	0.23567	0.0517	0.0973	0.000	0.028
cpi	-0.0658615	0.0306	0.02566	0.032	0.021
fcep	-0.2208	0.0587	0.072	0.000	0.007
reer_2010	-0.0472	0.0102	0.0261	0.000	0.090
lab_mark_regul_ief	-0.48365	0.2196	0.3274	0.029	0.150
gfcf	0.04551	0.01697	0.01655	0.008	0.014
_cons	14.535	1.6987	3.5612	0.000	0.001

Table 2.4

Testing for random effects of panel regression in model 2

Test name	Chi2 statistics	P>Xi_2
Hausman test	3.76	0.7096
Breusch-Pagan test	562.99	0.000

Model 3

Last model compared with previous shows worse results. Despite the same sign of all regressors, even in model with simple standard errors variables *cpi*, *reer_2010*, *real_int_rate*, *gfcf* are not significant at the 10% level. Coefficients of determination are very low (<0.1), although according to F-test all variables are not equal to zero. As well as in model 1 and model 2 Hausman test shows no endogeneity and no difference between coefficients in fixed and random effects.

Table 2.5

Results of panel regression based on model 3

Number of observations	336				
Number of observation groups	24				
F-statistics (6,600)	4.43				
Prob>F	0.00				
F-statistics (all u_i= 0) (6,600)	67.73				
Prob>F	0.00				
R^2					

within	0.0799				
between	0.0645				
overall	0.0442				
corr (u_i,Xb)	-0.0049				
unemp_tot	Coef.	Std. err	Cluster-st.d robust errors	P>|t|	P>|t|, robust
real_int_rate	0.0486	0.0486	0.029	0.014	0.253
cpi	-0.0587	0.0387	0.044	0.130	0.200
fcep	-0.153	0.0562	0.07	0.007	0.066
reer_2010	-0.0161	0.0143	0.0291	0.259	0.584
lab_mark_regul_ief	-0.5953	0.3152	0.5953	0.060	0.327
gfcf	0.009	0.017	0.0128	0.586	0.474
_cons	13.55	2.433	13.55	0.000	0.001

Table 2.6

Testing for random effects of panel regression in model 3

Test name	Chi2 statistics	P>Xi_2
Hausman test	1.8	0.937
Breusch-Pagan test	1791.18	0.00

To sum up, results of modelling show that monetary and non-monetary variables have impact on unemployment in both developed and developing countries. Frazer Institute pillar Labour market regulations influences unemployment negatively, so that in countries with lower bargaining power of workers, larger wage flexibility, simpler proceduces of hiring and firing unemployment level is lower. Growth of private

consumer expenditures is better proxy of GDP growth and inverse indicator of this indicator is predictable. Conversely, large growth of capital expenditure in economy may indicate that either enterprises want to substitute labour by capital or receive more benefits from fixed assets in the future. Therefore, positive impact of gross fixed capital growth on unemployment is clear. However, as it was noticed it theoretical part productivity growth, which can be achieved partly by capital accumulation or technological progress, in the long-run has no impact on unemployment.

Interesting results show monetary variables: real effective exchange rate, inflation and real interest rate. Real effective exchange rate impacts unemployment negatively, which resembles to be illogically. However, increase of real effective exchange rate is often accompanied by growth in output and expectations, when unemployment is reducing due to ascending phase of business cycle. Negative relation between inflation and unemployment is known for long time and central banks should not derive any implications from it. Shape of Phillips curve varies among countries, while efforts to reduce unemployment by broadly raising inflation rate were fruitless during recent decades.

Confirmed inverse relation between real interest rate and unemployment has several implications for central banks. Firstly, as noted by O. Blanchard monetary can have large and long lasting effects on output and employment. A sustained increase in real interest rates leads first to an increase in the actual unemployment and latter after capital accumulation decreasing to the natural level unemployment too. It means that as time elapses a difference between current and natural unemployment reduces and tight monetary policy becomes less effective. To avert the detrimental effects of long-term high real interest rates central bank should more actively promote policy aimed to reduce cost of capital. [58]

Difference between models among various countries confirms that the link between labour market and financial sector is stronger in developed countries. It can be explained by both stronger transmission mechanism of monetary policy and better accuracy of unemployment variable. Developed banking system and stock market

means that enterprises' decisions depend on level of inflation and interest rates, while unemployment rate better encircles those who are genuinely want to work, because usually shadow sector is low.

Conclusions to the Chapter II.

A history of central banking showed that modern approach of central banks to officially ignore real sector variables was not common in the past. Despite being created to fulfil a role of the lender of last resort and government funding central banks have been evolving during centuries. After World War II major central banks began to concern about developmental initiatives: output and employment growth. Therefore, monetary authorities began to support government policy by making loans cheaper and facilitating lending of separate sectors. Situation changed since 1970s when central banks reoriented to control prices as a respond to stagflation. Modern central banks officially declare price and financial stability as core macroeconomic objectives. However, there are several countries, where monetary authorities still have dual mandates: to provide price stability and maximum employment. The most famous among them is Federal Reserve System in US, which more than 40 years targets both inflation and employment.

Considering concern of monetary authorities about real sector performance, it was found that monetary indicators such as consumer prices, real interest rate and real effective exchange rate affect unemployment. As predicted by the Phillips curve inflation has inverse with unemployment. Higher real interest rate suppresses crediting and positively affects unemployment. Overvaluation of national currency negatively affects unemployment, because it is assumed that it occurs in periods of business cycle growth phase. Presence of monetary variables impact on unemployment means that central banks can carry out monetary policy to change official unemployment rates. However, degree of influence varies depending on level of country development. Probably, developed countries have more precise labour market indicators and better

transmission mechanism, what explains stronger impact of monetary indicators on unemployment.

Actual results only generally describes the impact of monetary variables on unemployment. Current research can be supplemented by modelling respond of unemployment to particular central bank's actions. Open remains the questions about duration horizon of monetary policy actions on labour market, difference in sensitivity to central bank's actions in countries with different labour markets.

CHAPTER III. LIST OF POLICY FRAMEWORKS AND MONETARY INSTRUMENTS TO IMPROVE LABOUR MARKET PERFORMANCE

3.1 Alternative monetary policy goals and frameworks

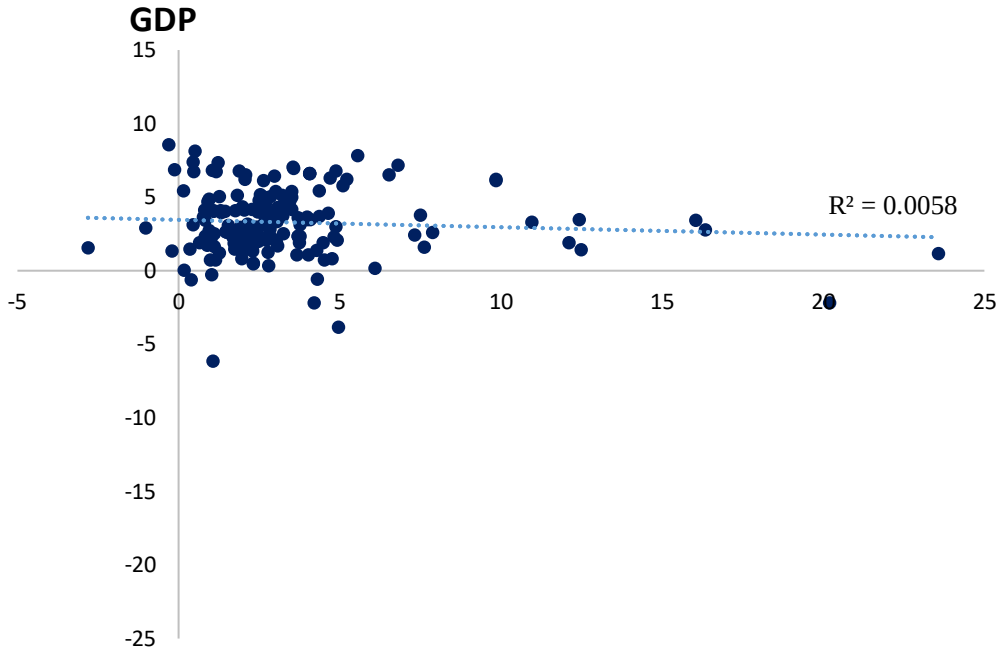
Last three decades were characterized by ubiquitous spread of 2 ideas in monetary thought around the world: macroeconomic and financial stability. A common target of well-being was chosen inflation, which has become an inherent part of most central bank mandates around the world. Since 1989 41 countries have adopted IT as a monetary regime, while majority of others proclaim price stability and use monetary targeting or exchange rate anchor to hold CPI in determined bands. Responsibility for financial stability expanded as a reply to Global Recession.

Together with movement towards low inflation and financial prudence central banks has turned to be more transparent and independent. Theorists argued that best impact monetary and fiscal policies have when they are independent from each other. Such distribution of powers allow to mitigate political cycles and raise trust to monetary authorities.

However, opponents of inflation targeting and adjacent regimes, which concern about price stability, give several strong arguments undermining orthodox monetary regimes frameworks:

- By adopting IT regime central banks set consumption price index as an objective. However, by concerning with limited list of final product prices, which are included in CPI, central banks ignore other metrics. Prices of securities, real estate, intermediary goods & services are often remaining beyond the stage, while these categories also determine money value; [33]

- Low and stable inflation is not necessary for economic growth. G. Epstein in his seminal work argues that high rates of economic growth are achievable even at inflation at 20% per year, while low inflation is not a guarantee from weak growth of output and high unemployment rates. Real data proves this statement. On the chart 3.1 we can see that >80% of countries perform low CPI (<10% per year) but real GDP growth varies greatly. Moreover, a large variety of studies show that IT regime does not lead to higher economic growth and disinflation has its costs; [52]
- Inflation rates above 3-5% eases perception of cut in real variables so that simplifying implementation of fiscal and monetary policy. Real wages cut caused by rise in inflation remains less noticed compared with decline revealed in nominal numbers diminishing. For example, losses 3% of real wage because inflation growth is less noticeable compared with 3% cut due to 3% decrease of nominal wage;
- Higher inflation gives more space for central bank to fight recession. Basically, in countries with higher inflation nominal interest rates are higher. Therefore, in period of recession central bank can handling better by decreasing policy rate and achieve lower (negative) real interest rates to boost output and employment; [1]
- Inflation target can be achieved by sacrificing other important targets such as employment creation or real growth. While fighting inflation Central banks are increasing their policy rates. Evidence shows that in the majority of cases central banks overshoot their targets by overdoing discount rate raising, which can hamper macroeconomic growth.
- Inflation should not be a major concern in economies with large share of population beyond poverty line. Jha (2008) argues that low-income countries need economic growth of 8% annually, which can be achieved by policy of low interest rates and undervalued currency exchange.[52]



Picture 3.1. Inflation vs real GDP growth by country, % 2018

Source: elaborated by author on the base of [67], [68]

Considering imperfect results showed by IT and adjacent regimes with price stability mandate during last 30 years scholars have developed a list of possible alternative monetary regimes and supplementary tools that concern more about economic development or employment of economies. Some of them, such as labour standard are pure theoretical concepts, which, rely on and borrow some tools from monetary regimes of the past. Others appeared as a respond to modern neo-liberal mainstream orthodoxy to achieve long-term low inflation rates. These monetary policy approaches can be used as a supplement to IT or can even alter it or offset to the background.

3.1.1 Labour standard [51]

Labour standard (LS) is a monetary regime proposed by E. Thompson and D. Glanser in 1980s as a respond to Federal Reserve mandate in United States: adherence to both price stability and maximum employment.

Scholars argued that critique of the gold standard is spurious and regime called labour standard based on it may take place. According to the opponents of the gold standard, gold price freezing at $x per oz. creates arbitrage opportunities and fluctuations in real prices of this commodity. Unexpected discovery of gold deposits would bring large inflows of gold into economy and destabilize costs/prices structure in economy. For example, supply increase without significant changes in demand causes prices expansion, which happened in Europe after New World discovery by Columbus. Thompson and Glasner propose that under gold standard amount of labour should be fixed at some level, for example, $20 per hour. Then, central bank should compensate individuals any sums that caused changes in real price of labour. For instance, when buyer decides to purchase additional 100 hours of labor for $25, then monetary authority will transfer him additionally 5*100=500 equivalent of gold. Generally, under LS Central bank actively carries out market operations with a gold to keep nominal wages.

Proponents assert that LS is free of Gold standard shortcomings:

- Unlike gold standard price fluctuations are caused by real sector variables: productivity, structural changes in the economy.
- Market, not Central bank, determines whether current policy is too strict or to loosening. Legal entities and individuals would purchase or sell gold to the Central bank smoothing the business cycle.

To sum up, apologists assume that LS would allow Central bank to achieve simultaneously both targets: maximum employment and price stability. Central will sell and assets on the open market, while prices will adjust to changes in real variables.

3.1.2 Nominal GDP targeting

Theoretical reasoning of nominal GDP (NGDP) targeting refers as far as to F. Hayek, but firstly the whole concept was introduced by James Meade and James Tobin. In 1980s. Regeneration of a concept took place during Great Recession period, when

market monetarist Scott Sumner explained possible benefits of this monetary regime in recession periods.[1]

Under NGDP targeting Central banks choose either level of NGDP or the growth rate. Then it is adjusting its monetary policy loosening or tightening to achieve annual or every two year target level. Considering targeting of a single variable, central banks should pay attention to proper forecasting and clear communication about its intentions. Selection of what variable to target is arbitrary, but economists propose to target NGDP level when large shocks take place. In such scenarios, Central bank will be able to achieve target, which was under- or overshooted in the previous period, in the next period, thereby endorsing its credibility.

Advantages compared with Taylor rule, used in IT

A key difference between NGDP and IT targeting is the targeting indicator and specification of monetary rules. While Taylor rule refers to the determination of discount rate, which is calculated by measuring inflation- and output gaps, NGDP targets growth of nominal spendings. Simplicity of target brings several advantages for NGDP targeting compared with IT:

- *Simplicity of target.* Output gap, which is a part of Taylor rule can not be measured precisely. Dispersion of information in economy makes it impossible for the central bank to calculate accurately and timely real sector variables. Thus, difference between ex ante and ex post estimations are significant. For example, investigations by Federal Reserve for the period 1987-2007 showed that forecast error in output gap can be up to 13%.[59]
- *Low volatility of target.* In majority of countries consumption composes more that 50% of GDP and this indicator does not vary significantly in middle-term. Therefore, large shifts in output are usually happening due to fluctuations in expenditures.

- *More efficient respond to supply shocks*. Different supply shocks, for example, leap in commodity prices can lead to rapid growth in oil prices. Under IT a common respond to this shock will be raise of policy rates, which is detrimental for the economy, while under NGDP targeting the loss from the shock is distributed between higher ex post inflation and lower decline in output (Chart 3.2)

Drawbacks [50]

- *Miss of the target.* Annual or quarterly output depends on many factors: consumption levels, business expectations, fiscal policy, external environment. Thus, macroeconomists often revise their forecasts. Central bank will be obliged to do the same, despite more powerful arsenal of data and models.
- *Revision and quarterly basis of GDP indicators.* Compared with inflation numbers, which are published monthly, GDP data is available only on monthly basis and is revised ex post.
- *Acceptance by the public.* To communicate its intentions to target nominal GDP Central bank should clearly explain to the public several adjacent concepts: deflator, nominal vs real GDP.

Possible impact on labour market

Despite not being implemented anywhere, from theoretical aspects it can be concluded that NGDP targeting would be favourable for employment. Central bank adjusts its policy to prevent deviations in nominal spendings. Such policy will prevent large fluctuations in unemployment because Central bank use its tools to remain stable level of spendings in the economy.

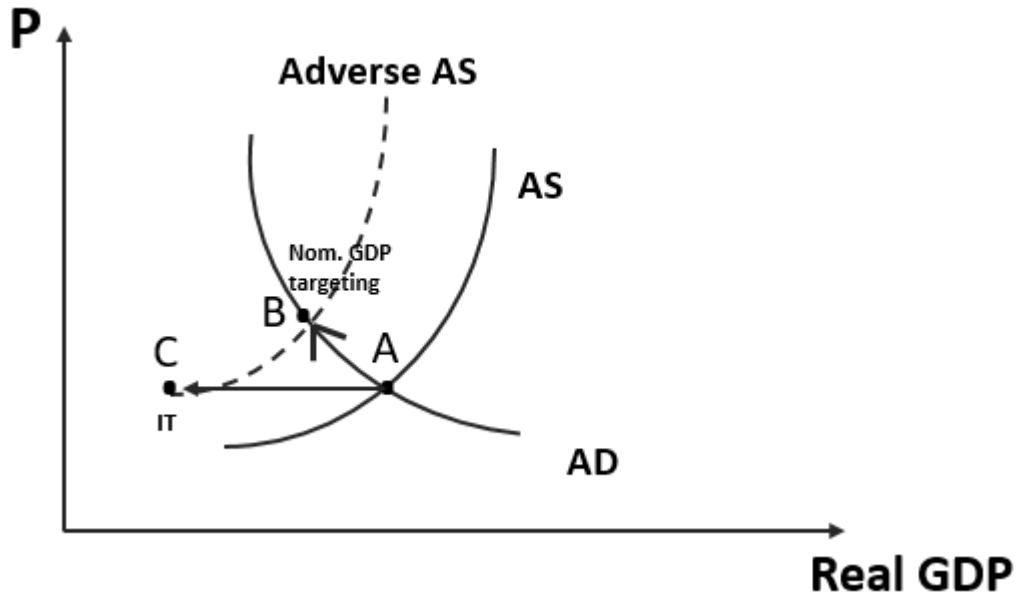


Chart 3.2. Comparison of IT and nominal GDP targeting costs under adverse supply shock

Source: [50], p.9

3.1.3 Employment targeting [49]

Employment targering (ET) is a monetary regime, when central bank switches from targeting the inflation to one of the labor sector indicators, such as unemployment, employment growth and adjacent. Under ET monetary authorities are conducting policy to provide stable employment, while inflation concern policymakers only at enough high constraints (up to CPI 20%). Nowadays, no country solely targets labour market indicators, but targeting of unemployment is a part of central bank with dual mandates.

Proponents of employment targeting argue that zero influence of monetary policy on real sector variables is wrong. It is only a doctrine of neo-liberal economic thought, while other less popular economic theory schools (Keynesian, Kaleckian, New/Post Keynesian) admit such impact. Current poor level of investigations between monetary policy and employment can be overcome by facilitating research on this direction. Business, NGOs, labor market players would help central banks to calculate and

forecast key labor market variables more precisely. New researches can bring new models and forecasting method, which would solve the problem of inaccurate gauge of real sector variables' gaps.

Switching from inflation targeting to ET requires a spread of monetary tool kit. Discount rate keeps its meaning but several instruments used by the central banks in the past will renew their importance. Firstly, Central banks can establish or support by direct lending development banks – state-owned enterprises, founded to finance particular sectors or projects in the economy. Then, monetary authorities can manually influence lending provided by banking sectors. Central banks can impose quotas on lending for particular goal (such as employment creation) or foster bank with lowering reserve requirements depending on the invested assets. One more option is to secure loans issued to generate employment or help with securitization of lending.

Despite its attractiveness targeting of labour market indicators can be burdensome for central bank and feasibility of failure is great. Firstly, while inflation is a monetary phenomenon, labour market variables are determined by dozens of non-monetary factors: preferences between work and leisure of economic agents, labour market institutions, global market trends. Secondly, a natural unemployment rate is actually unobservable variable. In real time we do not know exactly how to measure it, when need inputs for our policy decisions. Revisions of macroeconomic forecasts in United States showed that potential GDP ex post deviated significantly from ex ante value, which in reality will bias expected results of policy decisions. [29] Thirdly, promises to create new jobs or reduce unemployment are politically sensitive issues. Government or captured central bank can exploit such rhetoric to win next elections by excessively loosening monetary or fiscal policy. However, in long-term period such policy is destructive for the economy.

3.1.4 RER targeting

Real exchange rate targeting policy is based on the notion that central banks should concern not only with stabilization objectives but with developmental too. Currency

interventions primarily should be done to facilitate resource allocation, create workplaces, while put less emphasize on controlling external balance or inflation.

Theoretical acceptance of RER stems from the international economy. Proponents argue against classical trilemma, when central bank independence, fixed exchange rate and free capital flow are not feasible to hold simultaneously. Modern central bank, which often chooses free capital movement and independence, at least, sometimes make currency interventions or temporarily impose restrictions on currency movement. By criticizing trilemma that simple rejection of fixed exchange rate in favour of other two nodes is not maximum efficient for the economy.

Advocates claim that long-term real appreciation has detrimental effects on production. Cheaper foreign import crowds out some share of production in non-tradable sector, while appreciated national currency diminishes competitiveness of exporters. As a respond to the external shock entrepreneurs must dismiss part of workers, who will not necessarily find new opportunities in non-tradable sector. Real appreciation can be also favourable for policymakers. Prices are falling, purchasing power is rising, which as if proves the competence of authority. However, over time negative consequences, for example, of fixed exchange rate will become visible. Thus, national economy can suffer from negative effects of currency appreciation on employment. Conversely, depreciation of currency can have positive effects on economy. National output can boosted by decrease of overseas imports, while exporters will be able to deliver more goods & services abroad.

Firstly, to implement RER targeting scholars in some occasions suggest to impose control over capital flows. It is relevant especially in low and middle-developed countries, which are vulnerable to large inflow or outflows of capital. Secondly, countries should prioritize and adjust number of their monetary targets, because according number of instruments should be equal or higher than targets. Thirdly, to gain favour from RER targeting government as a supplementary tool should establish some developmental initiatives. Fourthly, central banks should concern with other monetary shocks such as unstable monetary demand. [48]

3.2 Supplementary monetary policy instruments to promote developmental goals

Usage of widely spread central bank policy tools (currency interventions, discount rate, communications etc.) can be not enough to meet specific labor market objectives. Postwar experience of developing countries demonstrate that central banks can successfully use several less pervasive set of instrument to have impact on labor market:

1) ***Asset backed reserve requirements.*** Basically central banks must hold some reserves for their income-earning assets. To facilitate lending to particular spheres, for example, those that boost employment or productivity growth, reduce poverty, central bank can free from reserving employment-generating assets.
2) ***Loan guarantees***

   Majority of developing countries show modest numbers of banking lending related to GDP. Relatively high interest rates and high probability of borrowers' default hampers to allocate capital efficiently. Loan guarantee is an instrument, when government with central bank facilitation compensates some share of loans issued for special purposes. For example, fiscal authority repays to the bank interest on the loan or some share of amount outstanding. Therefore, commercial banks provide loans to borrowers, who satisfy developmental criteria: create jobs in prioritized sectors, invest in innovations, green energy or infrastructure. Considering initially high searching costs government can interact with intermediaries, who will perform due diligence and seeking of potential borrowers.

   While implementing loan guarantee program governments will necessarily face moral hazard issue. Thus, amount of loan guarantee must be limited. Complementary way to prevent default and fraud can be effective monitoring procedures and reward for whistleblowing.
3) ***Capital management***

Central bank capital management techniques are divided into two main categories:

1) *External capital management.* Monetary authorities control flow of private capital: create conditions for FDI, impose/cancel restrictions on repatriation of dividends.
2) *Internal capital management.* Primarily central bank concerns with banking system maturity, allocation and mismatch to provide macrofinancial stability.

Generally central bank implement capital management to pursue macroeconomic goals (employment, output growth, etc.), protect country from shocks (currency, interest rates swings) and minimize losses from economic crisis.

4) RER management

Central banks can not only consider RER targeting management as a monetary policy regime, but also as one of its instruments. As a supplementary tool central bank can control supply of foreign currency to prevent large swings and extinguish speculations. As Epstein notes some Central banks are exposed to inactivity, when national currency is appreciating, therefore disrupting competitiveness on the international market. To prevent such deficiencies monetary authorities should set exchange rate upper floors, when plethora foreign currency will be purchased from the market.

5) Investing in private or state sector entities

Some central bank hold securities of private or public banks or other financial institutions. Monetary authorities hold such balance sheet items:

- as a result of emergency action in the past such as repurchase of bonds or mortgage-backed securities;

- To participate in management of institutions, for example, developmental banks.

One the methods to make sound investment is support of developmental initiatives in some geographic areas. For example, Federal Reserve Bank of Boston in partnership with community development non-profit living cities identifies and supports development projects in New England.

Other option is to issue long-term securities to support developmental initiatives. Such assignations can be done in form of bonds issuance for infrastructure, climate change or energy safety initiatives, which, for example, are fulfilled by the Central of Kenya. [18]

Case study: Monetary policy and employment creation in Asia [47]

International Labour Organization

In 2012 ILO Regional Office for Asia and the Pacific published report named "Monetary policy and employment in developing Asia". The author N. Bhattacharyya investigated peculiarities of Asian developing countries monetary policy concerning objectives of full employment and poverty reduction.

As well in other parts of the world a key mandate of Asian countries' central banks is price stability. No country has clipped an employment target in legislation framework. Explicitly some countries define one of their objectives support of high employment levels (e.g. Bangladesh). But implicitly majority of Central banks concern with employment indirectly: via supporting credit programs, bank prescriptions or interaction with government.

One of the most popular activities to promote employment is lending targets. Central banks foster or oblige commercial banks to provide lending to some sectors or areas of the economy. For example, The Reserve Bank of India requires commercial banks to direct a certain percentage of their loan portfolios to priority areas, Central banks

in Cambodia and Viet Nam assign lending targets to commercial banks for specific sectors, in China Central bank guides commercial banks, in which sectors to lend.

Second popular tool is refinance programs. Some Central banks in Asia finance a part of issued loan, when it meets a predetermined criteria. For example, in Bangladesh became popular SME financing, in China preferential crediting of areas under disaster, while in Pakistan financing of areas suffered from military conflict.

Other Central banks' initiatives are directed to spread financial inclusion among citizens and to facilitate access to borrowing for small business.

After analysing Asian experience in achieving favourable employment levels author concludes that central banks should not proclaim a full employment or adjacent goals as an official monetary target. Widespread monetary indicators such as unemployment are usually meaningless in developing countries, because majority of non-employed in official sector belong to non-wage employed category. It means that measurement of popular indicator non-accelerating inflationary rate of unemployment (NAIRU) is burdersome: in developing areas: it is hard to disconnect structural from cyclical component. Another problem is absence of frequent and precise data and labour surveys. Many countries perform only brief or even none analysis of employment trends.

To nigh employment objectives Asian Central banks should make more effort to develop financial system and literacy among citizens. Developed banking system and stock market would alleviate access to funds for SME sector, which certainly deposits to creation of working places. Another way to facilitate employment is closer cooperation between Central bank and government: monetary authority considering its proficiency in macroeconomic analysis can give its advice.

3.3 List of proposals for Ukrainian monetary and fiscal authorities to better incorporate labour market variables into policy making

3.3.1 Consider issuing annual environmental report, explaining strategy concerning climate change

Despite direct absence of employment objective in the Law of Ukraine "On the National Bank of Ukraine" sustainability of the economic growth is clipped as secondary objective of our Central bank. [46] According to definitions accepted by international economic community *sustainability* refers to harmonized economic growth, which means considering environmental risks. By adhering sustainability objective NBU is among 54 central banks that explicitly or implicitly reveal in their mandate concern about "Green" activities.[45]

At the first blush, economic policy related to environment, climate change, green finance are far enough from employment or economic growth and monetary policy. Usually in each country exists a public body responsible for ecology and protection of natural environment. Annually government allocate budget funds to support environmental conservation. Nevertheless, climate change and pollution of natural environment to a greater or lesser extent may touch everyone and central bank is not an exception.

Firstly, in 2008-2009 financial crisis compelled leading Central banks to elaborate new financial metrics, international banking standards (Basel III) and rules to keep financial stability. So that, monetary authority should at least concern some aspects of coming climate challenges that influences global economy to some extent even today.

Secondly, incorporation of climate change issues is important in countries with large agricultural sector: according to World Bank in 2018 in Ukraine share of agriculture, forestry and fishing composed 10% of GDP and 15% of employment. Climate affects volatility of agrarian production that can have broader impact on employment and aggregate output. These supply shocks can destroy industrial capacities and lead to

productivity shocks. As a consequence, food prices fluctuate significantly from season to season surprisingly affecting CPI – a pillar of price stability.

Thirdly, climate changes will affect energy and other sectors too. To fulfil international climate arrangements national governments will be obliges to impose restrictions on dirty producers, for example, carbon tax. These measures can cause output declines, unemployment rise and inflation spikes. Central banks depending on monetary regime may be compelled to modify their policy rules.

Fourthly, Carney (2016) assumes that in the future it is possible that "climate Minsky moment" – an unexpected climate related risk trigger will take place. New climate challenges will compel central banks to incorporate environmental inputs to their systematic risks.[45]

Considering relevance of "Green" central banking activities NBU should consider implementation of several explicit initiatives present among 20 central banks around the world:

- *Join Sustainable Banking Network (SBN)* and/or *Central Banks and Supervisors Network for Greening the Financial System (NGFS)*. These international institutions encompass national central banks and financial regulatory institutions that want to make efforts to mitigate climate risks and mobilize financial resources to achieve sustainable development.
- Release documents covering climate change and environment conservation themes. Several Central banks periodically prepare reports in which embrace strategy in connection with climate changes, describe risks, which climate changes bring to a monetary policy.
- Facilitate funding of "green" projects. In several countries central banks take part in green bond schemes, initiate amendments referring to "green" finance, issue green lending standards.[45]

3.3.2 Add new labor market indicators

State Statistics Service of Ukraine at least quarterly publishes labor market data. This statistics embraces all key labor data subjects required by International Labor Organization (ILO): labor force, employment, youth, remuneration of work, social protection.

However, considering full employment objective aforementioned range of employment may not be enough. Bosler, Daly and Nechio (2014) used next type of Taylor rule to calculate optimal policy rate for US economy s[44]:

Target rate = 1.25 + (1.5 × Inflation) – (2 × Labor market gap).

While measuring Labor market gap variable authors concluded that depending on the type of utilized indicators (official unemployment, short-term unemployment and others) expected target rate varied from 0% to 4.5%. After analyzing time-series scholars noticed that behavior of different market indicators after Great Recession in US economy did not perfectly coincided – correlation coefficient among them had declined from 0.9 to 0.7. Uneven recovery of different unemployment indicators in American economy after Great Recession argues what share of unemployment refers to structural and cyclical (concern of monetary policy) components that is substantial in policy implementation.

Despite being developing country with deficiently well-grown financial sector extention of labor market indicators list can largely benefit our economy. NBU' models and forecasts would become more precise, policymakers would receive better inputs for their decision, while ordinary citizens would be more familiar with current employment trends.

To supplement our labor database State Statistics of Ukraine should launch calculation of next indicators[44]:

- *Short-term unemployment. Those in U3 who have been unemployed (as above) < 27 weeks;*

- *U4.* Official unemployment + discouraged workers who are available for and want work but have not looked in the past month because they do not think that jobs are available;
- *U5.* U4 + other marginally attached workers who are available for and want work but have not looked (for whatever reason) in the past month;
- *U6.* U5 + involuntary part-time workers.

Except for supplementing list of indicators, to better understand situation on labour market responsible public bodies should consider to issue monthly reports on employment situation, job openings and labor turnover survey.

3.3.3 Consumer credit protection provisions

Since 01.07.2020 NBU will become a regulator of non-banking financial sector: our central bank will be supervising insurance companies, pawnshops, credit unions and other financial companies. Considering complexity of financial services NBU should make clear standards of financial products disclosure to the customers. Despite not having direct impact on labour market unified criteria for unveiling of financial products peculiarities would increase trust to the monetary authority and make financial markets more efficient.

Consumer protection initiatives are implemented by central bank in several countries. For example, The Central Bank of Malaysia has a comprehensive consumer protection framework, which includes fair treatment of customers, financial education and distress management, while Federal Reserve requires banks and other creditors to provide detailed information to consumers about the terms and cost of consumer credit. [43]

3.3.4 Closer interaction with government on economic policy issues

Besides responsibilities to interact with state institutions written in Law more than half of central banks in both industrialized and developing countries make some form of advice to the government. Such counselling can be done directly via official governor,

who is an official economic advisor to the government. Other mechanism can be official membership of central bank governors on meeting of Ministry of Finance, other state bodies or vice versa. [43]

In addition to participating in meetings both central banks and governments can make comments on policy of each other. Such public communication can be really fruitful, when inconsistency between monetary and fiscal policy is substantial.

Conclusions to the Chapter III

Modern central banks that follow mandates of price and financial stability are not enough concerning with labour market indicators and developmental initiatives. Despite unquestioning benefits such frameworks have several disadvantages. To achieve low inflation central banks can sacrifice other goals, while the link between inflation and economic growth is absent.

To better cover labour market central banks can either activate secondary monetary tools or switch their monetary frameworks. As a supplementary monetary policy tools central banks can use: i) reduction in reserve requirements to facilitate banks lending, ii) buying securities of private or non-governmental entities to directly affect decisions about employment promotion; iii) exchange rate and capital movement to avert reduction in tradable sector competitiveness.

Except for most prevailing exchange rate anchor, monetary and inflation targeting monetary regimes are several frameworks, which require from central banks more concern about labour market indicators. Employment targeting requires central banks to carry out monetary policy to smooth deviation of current unemployment from its natural level. Nominal GDP targeting concentrates on holding stable nominal spending or rate of GDP growth. It means that unemployment would not severely deviate from its natural level considering Okun’s equation. Real effective exchange rate management provides stable well-balanced trajectory of real and monetary sectors.

Except for making alterations to the policy framework, there are several recommendations how to better incorporate labour market into public policy. National bank can:

- Include environmental sphere into policymaking;
- Renew legislation concerning consumer protection;
- Closer interact with the government.

CONCLUSIONS

Since 1970s price stability became a raison d'être of monetary policy. Central banks put aside developmental initiatives and predominantly suspended to achieve macroeconomic tangible goals. Monetarist theory became a core theoretical approach, which can be summarized in a phrase: “In long-term monetary policy does not have impact on real sector. Central banks gradually switched to control over money supply and reinforced the role of discount rate as a key macroeconomic instrument to control inflation. Facing failures in monetary targeting since 1990s more than 40 countries switched to inflation targeting and started to amplify monetary authorities independence. After Global Recession in 2008-2009 implicitly or explicitly central bank mandates expanded embracing financial stability. Despite moving towards internationally accepted standards of central banking – independent from government institution concerning price and financial stability – during last 30 years boost of GDP growth did not occur. Whereas Global Recession caused sharp rise in unemployment rates and productivity growth stagnation, and as of May 2020 covid-19 pandemic compelled many central to activate extraordinary policy tools to mitigate negative consequences of the crisis for employment and output growth.

This research investigated whether, how and is it worth for central bank to affect labour market. From the theory, all core macroeconomic instruments of monetary authorities have impact on decisions of both employers and employees in real sector via transmission mechanism. Discount rates and open markets operations partly determine cost of capital for enterprises and incentives to substitute consumption by savings of economic agents. Currency interventions have direct influence on competitiveness of enterprises in tradable sector. Nowadays, central banks also affect business expectations via communication with the public: by sharing press-releases, briefings etc.

However, tightness of central banks’ impact on labour sector depends on several factors. Firstly, peculiarities of labour market regulations in particular country. The

ease of the process of hiring and dismissing workers, lower relative minimum wages, weak trade unions facilitate lower unemployment and increases the fluctuations in labour market. Secondly, the development of financial sector is crucial for efficiency of central bank policy decisions. Higher sensitivity of real sector variables to monetary policy instruments determines success or failure of central bank interventions. In research-analytical part was showed that in developed countries impact of real effective exchange rate, real interest rate and inflation, which are targets of monetary policy, on unemployment is stronger than in developing countries. Thirdly, as noticed S. Collington, level of trust to the central bank is crucial for the functioning capacity. The lower is the credibility of authority the larger are deviations of macroeconomic variables from targets that complicates conducting of monetary authority.

Except for material factors, the degree of monetary policy impact on labour market depends also on one methodological aspect – precision of core labor market indicators: natural and actual unemployment, labor force participation, shadow employment. Classical unemployment index has several drawbacks: i) it ignores the movements within the unemployed; ii) it can be meaningless in countries with large informal sector that can explain low determination of monetary and non-monetary factors derived in research-analytical part. While natural unemployment despite durable theoretical basis in reality is unobservable variable and empirical investigations showed that ex post estimations can significantly vary compared with ex ante calculations.

Presence of monetary indicators impact on labour market raises a question how central banks should adjust their monetary frameworks and whether changes to their mandates must take place if monetary authorities are striving to concern more about developmental goal: employment and output growth.

Nowadays, majority of central banks follow one of main 3 monetary frameworks: exchange rate anchor, inflation targeting and monetary targeting that have their peculiarities relating to labour market. Under exchange rate anchor central banks can affect competitiveness of tradable sectors. IT is facilitating employment by creating certain economic environment. But, in time of economic crisis too excessive raising of

policy rates can disserve the economy. The link between real and financial sector is weak in countries with monetary targeting framework.

Despite different monetary frameworks modern central banks carry out their policy primarily to keep price and financial stability. However, in the past central banks concerned with developmental objectives. Research showed that as a respond to Great Depression repercussions since 1950s many European and Asian central banks began to support government actions to industrialize and accelerate economic growth, and, as a consequence, increased employment and productivity. To achieve these goals monetary authorities had been implementing loosening monetary policy for decades, were creating unique credit programs etc. That trend ceased only in 1970s as reply to two digit inflation.

Global adherence to price stability gave its results. Consumer price indexes fall from two digit numbers as of 1980 to 2.4% in 2018. Even so, in project-recommendation part from dozens of secondary central bank instruments and alternate monetary policy frameworks were highlighted and analyzed those that can be more beneficial for employment promotion.

There are 4 monetary frameworks that can give better results in promoting employment. Under nominal GDP targeting central bank targets averts excessive deviations in nominal spendings that can slowdown the growth of unemployment in times of financial crisis. Central bank that adheres to employment targeting ties core policy rate, open market operations or exchange rate to changes in unemployment, therefore directly influencing labour market. Real effective exchange rate targeting facilitates long-term competitiveness of national economy, thereby preventing job losses in tradable sector.

Feasibility to change monetary frameworks immediately raises question about mandate of central bank – single or several objectives clipped in law that designate the functioning of central bank. Investigation showed that objectives of majority of central banks comprise price stability with subsidiary macroeconomic variables such as

sustainable economic growth or maximum employment. To promote employment it may be rationally to displace maximum employment or adjacent goals from subsidiary to alongside objectives of central bank. There are several countries, where central banks formally concern with maximum employment just like price stability. However, investigation of the most well-known central bank with dual mandate Federal Reserve System revealed that it can be troublesome to target immediately employment with other objectives because of their inconsistency. Firstly, according Y. Tinbergen rule central banks should have control over one policy tool for each target that can be overburdening considering inverse relation between inflation and unemployment. Secondly, as it was noticed a natural unemployment rate is actually unobservable variable. Thirdly, maximum employment is politically sensitive issue.

To promote employment central banks should not necessarily change their overall monetary framework. There are monetary policy instruments that can be used to affect labour market. Firstly, central banks can exempt banking sector from fraction of reserve requirements if they are issuing loans aimed to create additional workplaces. Secondly, monetary authorities can more actively manage exchange rate and impose/cancel restrictions on movement of capital. Thirdly, considering ability to make open market operations, central banks can participate in management of institutions promoting developmental goals by buying their securities. Case study of Asian central banks revealed that many countries in that region are promoting employment by facilitating lending to individuals and SME, promotion financial literacy programs.

Findings of this research and international experience of central banks functioning give several hints how to further incorporate labour market into policymaking of National Bank of Ukraine and government. A key problem that should be tackled is poor labour market statistics. State Statistical Service of Ukraine should expand the list of labor market indicators and consider issuing larger set of reports about labour force turnover. At the legislative level should be clipped protections of financial services consumers after «split», while National bank should be allowed to comment economic policy of government and vice versa. To approach world standards of central banking NBU also

should join international SBN and NGFS communities and incorporate climate risks into its policy framework.

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ANNEXES

ANNEX I. DATASET OF COUNTRIES FOR ECONOMETRIC MODEL

Country_name	Country type according to UNCTAD classification
Algeria	developing
Australia	developed
Bolivia	developing
Brazil	developing
Bulgaria	developed
Canada	developed
Chile	developing
China	developing
Colombia	developing
Costa Rica	developing
Croatia	developed
Dominican Republic	developing
Hong Kong SAR, China	developed
Hungary	developed
Iceland	developed
Israel	developed
Italy	developed
Japan	developed
Korea, Rep.	developed
Malaysia	developing
Mexico	developing
Netherlands	developed

New Zealand	developed
Nicaragua	developing
Nigeria	developing
Paraguay	developing
Philippines	developing
Romania	developed
Russian Federation	emerging
Singapore	developing
South Africa	developing
Sweden	developed
Uganda	developing
Ukraine	emerging
United Kingdom	developed
United States	developing
Uruguay	developing

ANNEX II. FULL RESULTS OF MODELS 1-3

Model I

Fixed effects with simple standard errors

```
Fixed-effects (within) regression               Number of obs      =       649
Group variable: id                              Number of groups   =        43

R-sq:  within  = 0.0940                         Obs per group: min =         1
       between = 0.0861                                        avg =      15.1
       overall = 0.0794                                        max =        18

                                                F(6,600)           =     10.37
corr(u_i, Xb)  = 0.0338                         Prob > F           =    0.0000
```

unemp_tot	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
real_int_rate	.0588726	.0153593	3.83	0.000	.0287081	.0890372
cpi	-.0389675	.0223199	-1.75	0.081	-.0828022	.0048671
fcep	-.1300633	.0349596	-3.72	0.000	-.1987213	-.0614053
reer_2010	-.0263598	.0081706	-3.23	0.001	-.0424063	-.0103132
lab_mark_regul_ief	-.5856627	.1807858	-3.24	0.001	-.9407126	-.2306128
gfcf	.0163898	.0113379	1.45	0.149	-.0058769	.0386566
_cons	13.95753	1.386958	10.06	0.000	11.23364	16.68141
sigma_u	4.1188562					
sigma_e	2.1211618					
rho	.79038094	(fraction of variance due to u_i)				

```
F test that all u_i=0:     F(42, 600) =    59.49             Prob > F = 0.0000
```

Fixed effects with cluster-robust standard errors

```
Fixed-effects (within) regression               Number of obs      =       649
Group variable: id                              Number of groups   =        43

R-sq:  within  = 0.0940                         Obs per group: min =         1
       between = 0.0861                                        avg =      15.1
       overall = 0.0794                                        max =        18

                                                F(6,42)            =      3.91
corr(u_i, Xb)  = 0.0338                         Prob > F           =    0.0034

                                   (Std. Err. adjusted for 43 clusters in id)
```

unemp_tot	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
real_int_rate	.0588726	.03524	1.67	0.102	-.0122446	.1299899
cpi	-.0389675	.0254843	-1.53	0.134	-.0903969	.0124618
fcep	-.1300633	.0510853	-2.55	0.015	-.2331575	-.0269691
reer_2010	-.0263598	.0172392	-1.53	0.134	-.0611499	.0084304
lab_mark_regul_ief	-.5856627	.3767077	-1.55	0.128	-1.34589	.1745643
gfcf	.0163898	.0093453	1.75	0.087	-.0024697	.0352494
_cons	13.95753	2.551684	5.47	0.000	8.808018	19.10703
sigma_u	4.1188562					
sigma_e	2.1211618					
rho	.79038094	(fraction of variance due to u_i)				

Hausman test

	Coefficients (b) fe	(B) re	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
real_int_r~e	.0588726	.0575448	.0013278	.002582
cpi	-.0389675	-.0404708	.0015033	.0031726
fcep	-.1300633	-.1348847	.0048214	.0058765
reer_2010	-.0263598	-.0279785	.0016188	.0010432
lab_mark_r~f	-.5856627	-.5606777	-.024985	.0671448
gfcf	.0163898	.0171564	-.0007665	.00116

```
                 b = consistent under Ho and Ha; obtained from xtreg
  B = inconsistent under Ha, efficient under Ho; obtained from xtreg

    Test:  Ho:  difference in coefficients not systematic

                  chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =        4.22
                Prob>chi2 =      0.6466
```

Breusch and Pagan Lagrangian multiplier test for random effects

```
Breusch and Pagan Lagrangian multiplier test for random effects

        unemp_tot[id,t] = Xb + u[id] + e[id,t]

        Estimated results:
```

	Var	sd = sqrt(Var)
unemp_tot	24.34349	4.933913
e	4.499327	2.121162
u	17.03063	4.126819

```
        Test:   Var(u) = 0
                     chibar2(01) =  3231.77
                  Prob > chibar2 =   0.0000
```

Model 2

Fixed effects with simple standard errors

```
Fixed-effects (within) regression               Number of obs      =       277
Group variable: id                              Number of groups   =        17

R-sq:  within  = 0.1930                         Obs per group: min =         7
       between = 0.4432                                        avg =      16.3
       overall = 0.3376                                        max =        18

                                                F(6,254)           =     10.13
corr(u_i, Xb)  = 0.3178                         Prob > F           =    0.0000
```

unemp_tot	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
real_int_rate	.2356761	.0517438	4.55	0.000	.1337746	.3375775
cpi	-.0658615	.0306281	-2.15	0.032	-.1261788	-.0055442
fcep	-.2208006	.0587536	-3.76	0.000	-.3365068	-.1050944
reer_2010	-.0472439	.0102514	-4.61	0.000	-.0674325	-.0270554
lab_mark_regul_ief	-.4836548	.2196897	-2.20	0.029	-.9163001	-.0510095
gfcf	.0455134	.0169719	2.68	0.008	.0120898	.078937
_cons	14.53572	1.698783	8.56	0.000	11.19023	17.88122
sigma_u	2.2230976					
sigma_e	1.7030277					
rho	.63017968	(fraction of variance due to u_i)				

```
F test that all u_i=0:     F(16, 254) =    23.59            Prob > F = 0.0000
```

Fixed effects with cluster-robust standard errors

```
Fixed-effects (within) regression               Number of obs      =       277
Group variable: id                              Number of groups   =        17

R-sq:  within  = 0.1930                         Obs per group: min =         7
       between = 0.4432                                        avg =      16.3
       overall = 0.3376                                        max =        18

                                                F(6,16)            =      3.58
corr(u_i, Xb)  = 0.3178                         Prob > F           =    0.0192

                                 (Std. Err. adjusted for 17 clusters in id)
```

unemp_tot	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
real_int_rate	.2356761	.097367	2.42	0.028	.0292673	.4420848
cpi	-.0658615	.0256635	-2.57	0.021	-.1202657	-.0114573
fcep	-.2208006	.0720707	-3.06	0.007	-.3735837	-.0680175
reer_2010	-.0472439	.0261895	-1.80	0.090	-.1027632	.0082754
lab_mark_regul_ief	-.4836548	.3274341	-1.48	0.159	-1.177784	.2104745
gfcf	.0455134	.0165594	2.75	0.014	.010409	.0806178
_cons	14.53572	3.561263	4.08	0.001	6.986182	22.08526
sigma_u	2.2230976					
sigma_e	1.7030277					
rho	.63017968	(fraction of variance due to u_i)				

Hausman test

	Coefficients (b) fe	(B) re	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
real_int_r~e	.2356761	.2487533	-.0130773	.0114982
cpi	-.0658615	-.0667139	.0008524	.0049362
fcep	-.2208006	-.2216649	.0008643	.0110127
reer_2010	-.0472439	-.0502657	.0030218	.0023999
lab_mark_r~f	-.4836548	-.4879333	.0042785	.1030365
gfcf	.0455134	.0471415	-.0016281	.0015694

```
                 b = consistent under Ho and Ha; obtained from xtreg
  B = inconsistent under Ha, efficient under Ho; obtained from xtreg

    Test:  Ho:  difference in coefficients not systematic

                  chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =        3.76
                Prob>chi2 =      0.7096
```

Breusch and Pagan Lagrangian multiplier test for random effects

```
Breusch and Pagan Lagrangian multiplier test for random effects

        unemp_tot[id,t] = Xb + u[id] + e[id,t]

        Estimated results:
                         |       Var     sd = sqrt(Var)
                ---------+-----------------------------
                unemp_tot |  10.32886       3.213854
                        e |  2.900303       1.703028
                        u |   5.15522       2.270511

        Test:   Var(u) = 0
                             chibar2(01) =   562.99
                          Prob > chibar2 =   0.0000
```

Model 3

Fixed effects with simple standard errors

```
Fixed-effects (within) regression               Number of obs      =       336
Group variable: id                              Number of groups   =        24

R-sq:  within  = 0.0799                         Obs per group: min =         1
       between = 0.0645                                        avg =      14.0
       overall = 0.0442                                        max =        18

                                                F(6,306)           =      4.43
corr(u_i, Xb)  = -0.0049                        Prob > F           =    0.0003
```

unemp_tot	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
cpi	-.0587894	.0387999	-1.52	0.131	-.1351378	.0175589
reer_2010	-.0161906	.0143215	-1.13	0.259	-.0443717	.0119906
real_int_rate	.0486026	.0197102	2.47	0.014	.009818	.0873873
fcep	-.1531897	.0562488	-2.72	0.007	-.2638731	-.0425064
gfcf	.0093592	.0171535	0.55	0.586	-.0243945	.043113
lab_mark_regul_ief	-.5953326	.315271	-1.89	0.060	-1.215706	.0250409
_cons	13.55538	2.433995	5.57	0.000	8.765891	18.34486
sigma_u	5.1591987					
sigma_e	2.4451968					
rho	.81657477	(fraction of variance due to u_i)				

```
F test that all u_i=0:     F(23, 306) =     67.73             Prob > F = 0.0000
```

Fixed effects with cluster-robust standard errors

```
Fixed-effects (within) regression               Number of obs      =       336
Group variable: id                              Number of groups   =        24

R-sq:  within  = 0.0799                         Obs per group: min =         1
       between = 0.0645                                        avg =      14.0
       overall = 0.0442                                        max =        18

                                                F(6,23)            =      3.70
corr(u_i, Xb)  = -0.0049                        Prob > F           =    0.0101

                                    (Std. Err. adjusted for 24 clusters in id)
```

unemp_tot	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
cpi	-.0587894	.0449966	-1.31	0.204	-.1518719	.034293
reer_2010	-.0161906	.0291546	-0.56	0.584	-.0765013	.0441202
real_int_rate	.0486026	.0414444	1.17	0.253	-.0371316	.1343369
fcep	-.1531897	.0793269	-1.93	0.066	-.3172898	.0109104
gfcf	.0093592	.0128706	0.73	0.474	-.0172657	.0359842
lab_mark_regul_ief	-.5953326	.5945456	-1.00	0.327	-1.825244	.6345787
_cons	13.55538	3.602558	3.76	0.001	6.102918	21.00784
sigma_u	5.1591987					
sigma_e	2.4451968					
rho	.81657477	(fraction of variance due to u_i)				

Hausman test

	Coefficients (b) fe	(B) re	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
cpi	-.0587894	-.0623987	.0036092	.0058558
reer_2010	-.0161906	-.0178374	.0016469	.001933
real_int_r~e	.0486026	.046244	.0023586	.0035717
fcep	-.1531897	-.1624729	.0092832	.0110042
gfcf	.0093592	.0098413	-.000482	.0022072
lab_mark_r~f	-.5953326	-.5441708	-.0511617	.1256316

```
                     b = consistent under Ho and Ha; obtained from xtreg
          B = inconsistent under Ha, efficient under Ho; obtained from xtreg

   Test:  Ho:  difference in coefficients not systematic

                 chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                         =        1.80
               Prob>chi2 =      0.9371
```

Breusch and Pagan Lagrangian multiplier test for random effects

```
Breusch and Pagan Lagrangian multiplier test for random effects

        unemp_tot[id,t] = Xb + u[id] + e[id,t]

        Estimated results:
                         |       Var     sd = sqrt(Var)
                ---------+-----------------------------
                unemp_tot |  37.69843       6.139904
                        e |  5.978987       2.445197
                        u |  29.48363       5.429883

        Test:   Var(u) = 0
                             chibar2(01) =  1791.18
                          Prob > chibar2 =   0.0000
```