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The Transmission Mechanism of Unconventional Monetary Policy

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Abstract: The implementation of unconventional (nonstandard) monetary policy instruments by the leading central banks at the wake of the financial and economic crisis was the most significant shift in the practice of central banking in the recent years. Evaluation of their effects is not feasible without a thorough recognition of the transmission mechanism of various balance-sheet policies, such as quantitative easing. The transmission channels of a standard interest-rate policy are based on a group of theories that are relatively coherent and well-documented. On the contrary, identification of similar framework for unconventional measures proved to be a complicated task. The aim of this paper is to extract and evaluate the theoretical efficiency of particular channels of unconventional monetary policy. This goal requires references to at least several, to some extent mutually exclusive, theories. It is also inevitable to draw one's attention to the relative significance of identified channels, depending on the nature of used unconventional tools, as well as on reactions of financial institutions and other economic agents to undertaken actions. This paper discusses three broad channel of the unconventional policies transmission mechanism: the signaling channel, the liquidity channel, and the portfolio-balance channel.

Introduction

Intensification of the financial and economic crisis led to unprecedented cuts in interest rates by central banks around the World. However, in the last quarter of 2008 these actions faced three serious obstacles (see Wright, 2012). The first one was the zero lower bound, which caused the inability to cut main interest rates any further, even though the natural interest rate was negative. The second problem arose from a sharp increase in demand for reserves in the financial system, limiting the redistribution of liquidity among financial institutions and making central banks less capable of

controlling market interest rates. Finally, due to heavy distortions in monetary transmission mechanism, tradition interest-rate policy led to weak (or even no) reaction of economic agents to monetary impulses.Searching for an alternative or a substitute for traditional monetary policy many central banks chose to try unconventional or non-standard instruments.

The term "unconventional" monetary policy is used to describe a broad set of measured, directed both at financial and macroeconomic stability goals of central banks (compare Borio&Disyatat, 2009). They have been providing funds at longer maturities and use broader lists of accepted eligible collateral. Some of the policies involve changes in either the composition (qualitative easing) or size (quantitative easing) of a central bank's balance sheet. Qualitative easing often introduces "unconventional" (i.e. asset-backed securities) assets that replace "conventional" ones. Since the failure of Lehman Brothers, however, both approaches have been used simultaneously and changes have been denoted both in size and structure of central banks' balance sheets. Moreover, there has been a significant change in the way operations were carried by central banks and announced to market participant, such as forward guidance.

Implementation of unconventional policies also started a fierce debate concerningtheirnumerous effects: direct and indirect, intended and unintended, both domestically and internationally(see Krishnamurty&Vissing-Jorgensen, 2011).The lack of precise evaluation of these effects may be attributed to the insufficiency of empirical work in the field. The available empirical material is relatively short period of use of such tools as quantitative easing. What is more, numerous spillovers from the use of unconventional tools make it hard to isolate specific impact of certain policies.Yet this scare evidence also stems from the limitations of standard macroeconomic model and its theoretical predictions, particularly an incomplete analysis of the transmission mechanism of non-standard actions.

The aim of this paper is to identify and evaluate the channels of the transmission mechanism of unconventional monetary policy. The next section briefly describes the methodology of the research. Then I proceed to specific channels of transmission mechanism: the signaling channel, the liquidity channel, and the portfolio-balance channel. The last section concludes and points out several areas for the future research

Methodology of the research

In order to outline the transmission mechanism of unconventional monetary policy, this study makes use of a comprehensive literature research.Transmission mechanism channels of conventional monetary policy are a broad, but a relatively well-investigated group of concepts

allowing to have a better understanding of effects of interest rate changes in different economy sectors. Due to lack of thorough research in the relevant area, preparing a corresponding list for unconventional monetary policy seems to be a complicated task. The classic model gives only a narrow explanation of the effects of certain policy, referring to economic agents' expectations only. The attention is drawn to the differences between the theoretical assumptions of the model and the empirical results (Farmer 2012). The number of transmission channels that are used in different studies varies between two (Bernanke&Reinhart, 2004) and seven (Krishnamurty&Vissing-Jorgensen, 2011), depending on the author's approach.Additional difficulties arise due to high level of uncertainty in setting and measuring effects of different unconventional tools used simultaneously, recognizing their implications and presenting the possible scenarios of a reaction of a central bank. The attempt to isolate and evaluate channels of the transmission mechanism is of curtail importance. Not only allows it to define the recent outcomes, but also to evaluate the potential effects of the strategies of the exiting unconventional monetary policy.

Since there is no single coherent theory that allows to explain in-depth functioning of the transmission mechanism of unconventional monetary policy, this study analyzes different attempts to explain effects of non-standard tools and classifies them as channels of the mechanism. The paper involves various criticalreferences to theoretical and empirical studies.The conducted literature study makes use mostly of the recent literature, however, when needed, certain references to fundamental works is the field are made.The analysis of each channel is divided into three parts.The first one sets-up the underlying theories of a channel.The second part explains the details of particular effectsof monetary impulses.The third one providesan exemplification of how unconventional policies work through a channel works, as well as outlines condition of their effectiveness.

The Signaling Channel

The first approach to be discussed in the matter of explaining transmission of unconventional monetary policy's actions is the signaling channel (Bauer &Rudebusch,2013), also called the inflation risk channel (Krishnamurty&Vissing-Jorgensen, 2011). The analysis of transmission mechanism starts with thedescription of this channel, as from theoretical perspective, it is based on mainstream economic models. These modelsput a strong emphasis on inflation expectations in effective realization of monetary policy. And so signalling channel, in its core assumptions, is similar to the expectation channel of interest rate policy; the main difference being the actions or communicates of the central bank triggering

it that are far beyond the standard way of conducting monetary policy (Cecioni et al., 2011).

The idea behind functioning of signalling channel is so called neutrality proposition introduced by Wallace (1981), which states that the way of conducting the open market operations by the central bank has no impact on the dynamics of main macroeconomic indicators[1]. The hypothesis was formulated with the assumption of full rationality of agents, as well as completeness of financial markets. However, Curdia and Woodford (2010) claim that formulating it requires only two key assumptions:

- market value of assets depends only on previous cash flows – they not necessary have to be absolute substitutes, but the only differentiating criterion is their risk factor,
- all the investors can buy the same amount of assets at the same price; the only limitation being their budget constraints.

From the perspective of unconventional monetary policy, and balance-sheet policy in particular, the irrelevance proposition, derived from Wallace hypothesis, seems to be of crucial importance (Eggertsson& Woodford, 2003). According to this theorem, not only the operations of a central bank, but also the relative share of different assets in its balance, have no impact on the general equilibrium of an economy. There are two complimentary ways to explain this phenomena.

First of all, having two beforehand-mentioned assumptions fulfilled, calculating the current market price of each asset is based on pricing kernel, which can be understood as a discount factor of future cash flows generated by this asset. The pricing depends on the expected value of the marginal utility of income of a household, which is a random variable. The useunconventional monetary policy (e.g. qualitative easing) influences only shifts in distribution of available assets between a central bank and a private sector. However, it does not change the availability of stock to consume in the future. And so the assets pricing done by a household as well as its level of consumption is not changed.

On the other hand, if we assume that agents treat the balance of a central bank as a part of the general balance of a public sector (central bank and government), applying unconventional monetary policy will not lead to the "removal" of risk of certain assets, but rather to its transfer from the balance of private sector to the public sector. Having in mind that the balance of the public sector is protected by the tax income from the private sector, the rational agents will follow the Ricardian equivalence. The optimal choice of a household will be affected by the wish to protect future

[1] The Wallace neutrality reveals significant ties with theModigliani-Miller theorem, that states that the capital structure of a company is irrelevant for the value of this firm.

losses connected to higher taxation (the transfer of income). If the central bank buys certain assets, households will change their financial portfolio in order to neutralize its behaviour and keep the future income on the unchanged level.

Accepting the thesis on irrelevance of central bank does not necessarily mean that monetary policy has no impact on the on-going economic processes. The only thing is that the operations involving assets flow as well as expanding the monetary base will not be effective in the situation of liquidity trap. The temporal rigidities of prices and wages implies that a central bank has a possibility to affect the size of inflationary expectations, and indirectly on the deviation of the interest rate of a central bank (adjusted with the current inflation rate) from the natural interest rate, the price level and the size of the demand gap. Therefore, the signalling channel includes the following phenomena (Bauer &Rudebusch, 2013):

- stimulation of inflationary expectations,
- fall of the real interest rates,
- changes in the term structure of market interest rates, particularly the fall of long-term interest rates,
- increase in consumption, investments and the overall demand.

It is commonly assumed that using the signalling channel in the situation of zero interest rates comes from the seminal work of Krugman (1998). The recommendation he formulated might have seemed provocative, as it included a central bank openly supporting the inflationary processes' escalation[2]. Later on it was wildly commented within the formal models of Reifschneider and Williams (2000) or Eggerston and Woodford (2003).

The effectiveness of transmission of the monetary stimulus through the signalling channel is almost fully based on the reliability of a central bank, the appropriate communication of its intentions and the type of inflationary policy. In the situation when a central bank does not have a sufficient reputation, introducing the optimal monetary policy might be impossible. The realisation of the previous commitments might be also interrupted by the strong and persistent shocks that influence inflation but stay beyond the control of monetary authorities. Partial solution to the this problem is the complementary applying of the different unconventional tool. The changes of the structure or of the size of the balance may lead to the "strengthening" the effects of commitment on the expectations in the following ways (Lenza et al., 2010):

- increasing the power of commitments to preserve the monetary expansion for a longer time,

[2] In the exact words of Krugman (1998, p. 161), a central bank should be "committed to be irresponsible".

- causing fall in risk premiumcomponent of market interest rates,
- causing direct decrease of the of bonds and securities yields.

Applying the unconventional assets of the high value lowers also the probability of the quick rise of the interest rates, which would later lead to some financial losses of a central bank.

The way the signalling channel functions implies that the stronger effects in terms of economic activity will be caused by the unconventional tools of the wide scope and the ones requiring the strong involvement of a central bank. Among all, one should mention the instruments that require buying assets with the long-term maturity, which affects the flattening of the yield curves. The high effectiveness will be also a feature of the tools requiring future reinvestments of income from the current assets as well as of the "pure" form of quantitative easing, which includes buying bonds and securities as a point of reference to other values.

The idea of the signalling channel has been exposed to a strong criticism, mainly because of the derived conclusions, but also because of the theoretical background. According to some researchers, this way of explaining the effects of unconventional tools is far too narrow and it does not allow to capture its actual, even temporal, consequences in terms of market value of the assets or the cost of gaining the capital (Joyce & Tong, 2012). The objections mainlypoint out that the irrelevance theorem does not hold if one allows for a slight modification of its assumptions. There are certain non-pecuniary factors influencing risk calculation (such as agents' sentiments) which may boost demand for safe asset during financial crises (Gagnon et al., 2011). Some of the author, for instance Farmer (2012), acknowledge the theoretical construction behind the signaling channel, yet indicate its limited significance in practice.

As a results of this critique, recent studies interpret the signaling channels in a broader way than the standard model. In particular, the assumption of financial markets efficiency is repealed. This leads to a possibility to distinguish the so-called announcement effects, capturing the direct impact of new information on unconventional actions on actions of market participants (Gagnon et al., 2011; Szczerbowicz, 2014). Among these effects are not only shifts in inflation expectations, but also other consequences in markets segments in which unconventional tools are (or will be) implemented (e.g. increased liquidity or trade volumes).

The Liquidity Channel

The second channel of the transmission mechanism of unconventional monetary policy is the liquidity channel (Bowdler&Radia, 2012),

sometimes referred to as the bank funding channel (Joyce & Tong, 2012). According to the studies supporting this view, the effects of unconventional tools should be mainly view through the increase in liabilities of a central bank and reserves supply. Such policies are thus bound to improve balances of financial institutions and increase an overall availability of external financing to economic agents.

Historically, the first theoretical approach that allows to explain the functioning of liquidity channel is monetarism. One of the seminal works in this area is the influential paper by Brunner and Meltzer (1968). The authors analyzed several examples of changes in the demand for money under the liquidity trap and rejected the hypothesis of the complete ineffectiveness of monetary policy to overcome the trap. They found out, however, that the lower bound of interest rates is just a kind of an "institutional barrier", and not the effect of the infinite money demand. Consequently, changes in the official short-term interest rate (and also of some market interest rates) do not always properly indicate whether monetary policy is expansive or not. What is more, considering short-term interest rate as a first "chain" in the monetary transmission mechanism is often insufficient. Instead, they propose a very broad concept of this mechanism, in particular they suggest that all adjustments of relative market prices could be seen as responses to monetary impulses (shocks) (Meltzer, 2001).

The importance of the liquidity channel, according to the monetarist school, stems from the fundamental differences between the reserve money and other market assets. Due to the fact that agents use money as a store of value, it is considered by financial institutions as a safe asset when compared to more risky securities. Particularly during financial crises, when an average riskiness of other assets increases, the demand function of real money balances must have, at least asymptotically, a finite value. If one assumes, that the demand is a positive function of real transaction volume, and a negative function of an opportunity cost of holding money, then an increase in the nominal money supply may lead to a decrease in yields of securities held by financial institutions.

Consequently, the effects of unconventional monetary policies depend on shifts in a central bank's liabilities, and an increased monetary base should induce changes in broader monetary aggregates, even under the zero lower bound. The way unconventional monetary shocks transmit to the real economy is yet independent on assets in a central bank's balance sheet, including a structure of assets bought in order to increase the supply of money. Researchers that currently use this approach in empirical studies, suggests a possible way to use the liquidity channel in order to improve conditions in financial systems, for instance during the periods of a sudden

increase in money market interest rates. The effects of unconventional actions may cause a decline in liquidity premium components of interest rates, as they facilitate conversion of securities into money (Gagnon et al., 2010). Increased level of liquidity may then prevent commercial banks from credit rationing or fire-sales of assets, what eventually leads to higher aggregate consumption expenditures and investment.

An alternative theoretical explanation for the liquidity channel of unconventional monetary policy can be derived from the flow-of-funds class of models, which are mainly used for the national income accounting. Such an example is provided by the model of Cobham and Kang (2012), that captures and eveluates the effects of quantitative easing. This simple analytical scheme is based on relations among the basic sectors of the economy, represented as flows changing relative asset and liabilities positions through the modification of mutual financial claims. The flow-of-funds model comprising of such agents, as a central bank, a government, and financial and non-financial sectors can be built in a matrix form. Consecutive columns may be interpreted as budget constraints of each sector, while rows represent balances of supply and demand on financial claims, such as a financial deficit of government and private sector, bank deposits and securities.

The analytical framework of the flow of founds model allows considering the impact of monetary policy and the economic shocks on the changes of high-powered money, as well as the money supply, defined as a sum of changes in the amount of cash and the deposits on demand ($\Delta M_S = \Delta C + \Delta D$). The traditional monetary policy, based on the open market operations, will lead to the excessive liability of commercial banks ($-\Delta CB$) as well as the increase of reserve money (ΔR), and as a result the rise of a monetary base ($\Delta H = \Delta C + \Delta R$). The final result of those changes on the money supply will depend on the endogenous mechanism of credit creation in the banking system (Table 1).

Table1. The effects of quantitative easing in the flow-of-funds matrix

	Central bank	Government	Financial sector	Non-financial sector
Financial deficit	–	$G - T$	–	$I - S$
Bank deposits	–	–	$-\Delta D$	ΔD
Other liabilities	–	–	$-\Delta ND$	ΔND
Monetary base	$-\Delta H$	–	ΔR	ΔC
Government bonds	ΔGD_{cb}	$-\Delta GD$	ΔGD_f	ΔGD_{nf}
Central bank loans	ΔCB	–	$-\Delta CB$	–
Private sector loans	–	–	ΔK	$-\Delta K$

Note: positive values of flows denotes changes in assets, while negative values denote changes in liabilites of sectors;; G i T – government expenditures and taxes, D i ND – deposits and other liabilities of commercial banks, H – monetary base, including reserves (R) and cash (C), GD – government bonds, including bonds held by the central bank (GD_{cb}), by the financial sector (GD_f) and by the non-financial sector (GD_{nf}), CB – central bank operations, K – loans by financial sector.
Source: Cobham& Kang (2012, p. 56).

When the economy is hit by a financial crisis, the financial sector cuts down flow of loans to the non-financial sector (ΔK), what causes an equivalent decrease in deposits between sectors. As a result, despite any changes in in the monetary base (ΔH), market participants are subject to an adverse money shock, ($\Delta M_S < 0$), which slows down investment activities of companies. The limits of conventional interest-rate policy push the central bank towards unconventional actions, which are narrowed down in the model to purchase of government bonds from the non-financial sector by the central bank($\Delta GD_{cb} > 0$; $\Delta GD_{nf} < 0$). A decrease in the value of bond held by this sector lead to an increase in demand for deposits in commercial banks (ΔD). On the other hand, an increase in government bonds held by the central bank commercial banks, along with an increase in commercial bank liabilities, requires an equivalent flow of reserves (ΔR). If the above assumptions are met, quantitative easing leads both to an increase in the monetary base, as well as in the broader supply of money ($\Delta M_S > 0$). The liquidity channel of unconventional monetary policy can be thus perceived as a provision of a "liquidity buffer" by a central bank, which facilitates adjustments after financial crises.

The relative importance of the signaling channel is proportional to the kind of reaction of the financial system induced by the use of unconventional policies. This reaction, in turn, relies on the following factors:

- a degree in which money is exogenous to real economic activity,
- a value of money multipliers,
- a degree of an overall indebtedness and a pace of deleveraging in the economy.

In order to be effective, unconventional measure must, in accordance with the liquidity channel, facilitate available liquidity (reserves) to financial institutions. The examples of such measures involve long-term open market operations and enhanced liquidity support to certain segments of markets.

The Portfolio-Balance Channel

The third channel of the transmission mechanism of unconventional monetary policy is the portfolio-balance channel. The idea behind this channel relies on changes in the overall value and composition of a central bank's assets, and their impact on decisions of economic agents. As a consequence, this channel is also named in the literature as the portfolio re-balance channel (Cecioni et al., 2011; Bowdler& Radia, 2012) or portfolio substitution channel(Joyce & Tong, 2012). Conceptually, this channel may be compared, too some extend, to the wealth effects, balance channel and risk-taking channel of interest-rate policy.

The theoretical basis of the portfolio-balance channel is the preferred habitat theory, which received some attention over the past decades, yet is still considered as heterodox. Its origins may be tracked back to works of Tobin (1969), who proved that an average yield and risk factors specific to a particular class of assets are dependent on the relative market supply of these assets. Unlike the standard asset-pricing model, in which demand curves of financial assets are perfectly elastic, this theory assumes that heterogenic groups of market participants undertake their investment choices only in a particular segment of the market. Their so-called "habitat" depends on indifference curves of market agents regarding both an expected rate of return and risk of a specific asset class. Latest models building on this theory follow this assumption by allowing agents to choose only a limited segment of markets regarding the time structure of asset (a certain segment of a yield curve) (Vayanos& Vila, 2009). For instance, some of the agents may have preferences for particularly long maturities, that would match the structure of their liabilities and allow them to solve the so-called maturity mismatch problem. Consequently, market assets are

not considered perfect substitutes because of income they generate, but due to factors connected with their maturity.

The assumption of an imperfect asset substitution and market segmentation change the way that a central bank's purchases of assets influence portfolios of market agents. When a central banks starts buying a chosen class of assets, their market availability diminished, due to the so-called local supply effect (Bowdler&Radia, 2012). At the same time economic agent re-balance their portfolios in order to remain within a specific segment of the market. The process of quantitative or qualitative easing will then lead to an increase in prices of assets bought by a central bank. These price adjustments will depend on shifts in private sector's portfolios. Unlike the signaling channel, which emphasized the impact of unconventional tools on the risk-free interest rate, asset substitution will influence other component of market interest rates, such as (Krishnamurty&Vissing-Jorgensen, 2011):

- term premium, proportional to the maturity date of an asset,
- default premium, connected to the evaluation of issuer's default risk.

The decrease of these components may further cause an overall fall in various interest rates, increase the availability of loans to households and corporations, and boost consumption and investment. Rising prices of asset may, on the other hand, start balance-sheet and wealth effects, and eventually stimulate aggregate demand.

Recent studies on the transmission mechanism of unconventional monetary policy try to incorporate the portfolio-balance channel into and the preferred-habitat theory into the standard macroeconomic model. A significant contribution in this field was made by Farmer (2012). Farmer used a two-period general equilibrium model with rational expectation, and supplemented this framework by adding several assumption. Most importantly, the model incorporates a few different economic agents, one of which has only a restricted access to financial markets. In the first period, entitled agents buy or sell two types of financial assets. In the second period, they receive corresponding returns, which are subject to an extrinsic uncertainty, impossible to foresee in the first period, that changes relative prices of both assets. These effects are then transmitted to agents' real income, labor supply, and consumption.

Such a model makes it possible to compare two different cases: when a central bank remains passive, and when it uses qualitative easing, "replacing" agents that are not entitled to participate in financial transactions. Due to the heterogeneity of agents, a central bank's actions affect market prices of securities. Indirectly, qualitative easing leads to the redistribution of assets among agents, as well as transfers to market

participants characterized by higher propensities to consume. Based on this results, Farmer (2012) draws strong a conclusions regarding the portfolio-balance channel. He proves that unconventional monetary policy can be Pareto-improving, since it reduces the overall risk in the economy. What is more, qualitative easing can be implemented in an optimal way, when a central bank carefully choses its portfolio this policy may be self-financed and bears no potential costs for taxpayers.

An alternative approach to the portfolio-balance channel was introduced by B. Friedman (2013) in his "post-crisis" interpretation of the New Keynesian model. Friedman addresses the problem of the effects of unconventional policies by incorporating into the model two different interest rates. Next to the official interest rate set by a central bank, he introduces market interest rate, which is a basis of consumption and investment decisions in the economy. This, in turn, allows to reject the assumption that all assets are perfect substitutes, and incorporate the preferred habitat theory in the model. The key question concern factors influencing the market interest rate. Friedman assumes that the market rate is a function of the official rate, and its expected future path, as well as the ratio of risky assets to all assets. The higher the relative supply of risky assets in the economy, the higher the market interest rate.Unconventional monetary policy in this model can be understood as a process of decreasing the local supply of risky assets and transfer of risk to a central bank's balance sheet. Consequently, non-standard programs, such as quantitative easing can be used as a substitute to interest-rate policy.

A relative meaning of the portfolio-balance channel in the entire transmission mechanism of unconventional policy can be influenced by many properties of financial markets, as well as a central bank's decisions. Among the most important factor one should point out the following(Bowdler&Radia, 2012; Dahlhaus, 2014):

- accurate identification of dysfunctional market segments by a central bank,
- relative financial strength of a central bank to market, delimiting the upper limit of risk transfer from private sector to central bank's balance sheet,
- degree of substitutability of assets,
- average pace of portfolios rebalancing,
- response of prices and yields of assets to changes in their relative supply.

Qualitative easing, which involves outright purchases of chosen classes of assets, is undoubtedly among the most effective unconventional tools, when assessed through the lens of the portfolio-balance channel. The non-

standard operation in the segments of long-term securities may also induce rapid changes in private sector's balance sheets, and shift of demand to other, more risky assets.

Conclusions

The aim of this paper was to identify and evaluate the theoretical framework of the transmission mechanism of unconventional monetary policy. The analysis covered threebroad channels of monetary impulses generated by such policies, as quantitative or qualitative easing.The signaling channel, derived from the canonical model of the new neoclassical synthesis, underlines the importance of the so-called neutrality of central bank's balance sheet. This channel works mainly through stimulation of inflationary expectations and the subsequent the fall of long-term interest rates. Monetarist theory and the class of flow of funds models allowed to identify a liquidity channel, which effects rely on changes in central bank's liabilities. The liquidity channel stresses the importance of non-standard tools used by a central bank, which facilitate adjustments after financial crises. Finally, the portfolio channel is grounded in the theories of imperfect substitutability of assets, and explains the effects of shifts in value and structure of central bank's assets on decisions of economic agents. The overall impact of unconventional instruments is dependent on a decrease in various market interest rates, as well as increase the availability of loans to households and corporations.

Numerous unintended consequence of unconventional policies lead to the conclusion that their theoretical models are still not sufficient to fully explain complex impact of changes in central banks' balance sheets on financial markets and economies. In particular, there is an urgent need for a comprehensive theoretical model of international spillover effects of unconventional tools, that will allow to extract the effects of policies undertaken by the main central banks for the emerging economies, such as China. Another important area of future research is the exit strategy from the unconventional measures which, except for the case of the Bank of Japan, has no precedent.

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