THE EU EMISSION TRADING SYSTEM – THE AFTERMATH[1]

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RESUME
This article represents the final output of the IGA project: "Energetika a evropský systém obchodování s emisemi" ("Energy industry and the European system of emission trading"). Similarly to the two previous articles, it concerns one of the primary challenges of the European Union – global, economically and environmentally sustainable growth that is nowadays jeopardised by climate change caused by increasing concentration of greenhouse gasses in the atmosphere. Nevertheless, the article itself is conceived to be more general in order to fulfil the primary goal of the project, i.e. to present expert estimation of costs and determine main economic impacts of the reduction commitment under the conditions of the Czech economy, and indicate its possible influence on the on-going liberalisation of the energy market. The article builds both on the most important liberalisation trends and on the model outputs of the two previous articles. The authors' objective in this article is to provide qualified basic argumentation concerning mentioned conclusions and thus contribute to actual, very intensive and open discussion on this topic.

Key words: EU ETS, Climate and Energy Package, Market-Oriented Instrument, Emission Trading, Carbon Tax, Carbon Price, Carbon Leakage Energy Prices, Coal Prices, Emission Allowance Price, Climate Change

Introduction

As the title of the paper signals, the authors are once again going to deal with the issue of efficient mitigation of greenhouse gas emissions as a part of the overarching climate change policy based on shared efforts of all EU Member States. But this time they do not concentrate on a modelling exercise

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as was the case in the two preceding papers. Instead, they will concentrate more generally on the issue, providing some of the basic arguments in favour of the given conclusion, based, of course, on previous findings.

Just like in the previous work and despite of the current fashion, the authors are not going to question a basic premise of climate change policy. This is, in short, an acknowledgment of leaders that human activities cause higher greenhouse gas emissions released into the atmosphere, which in turns cause rising global temperature. As there are no further official findings but those from the IPCC, accepted internationally, we have to stick to them. They claim that if the Earth's temperature rises by more than 2 °C above pre-industrial levels, climate change is likely to become irreversible and the long-term consequences could be immense (for details see, e.g., Stern, 2006). On the other hand, if one takes an early action, climate change might be rather a challenge than a threat. These used to be broadly spoken arguments at the times when a common EU response was getting its basic shapes and when the issue might have been watched from the environmental perspective purely.

But then, with the onset of the recent financial and economic crisis in 2008, growing anxiety about long-term stability and predictability of oil and gas supplies from Russia, non-conceptual development in the field of initially supportive branches like renewables and biofuels, gradation in the positions of emerging countries, rebirth of the role of nuclear energy and, last but not least, the current political development in North Africa, the implementation of climate change policy is viewed from a bit different perspective. The privileged weight has been given to the issue of energy security as "the energy security of the European Union is declining very rapidly in comparison with other OECD countries and the USA. The European Union is thus in conflict with the fierce energy competition in the field of primary sources, which are located in other parts of the world, while becoming increasingly dependent on oil and natural gas from politically very unstable areas" (Vošta, 2009). Hence, fighting climate change and a path to low carbon economy have become a real, cross-cutting policy in the EU. As such, they are somehow reflected not only in traditional policies such as energy policy, regional development policy or development aid policy. At present they are extensively discussed in the context of transport, new financial perspectives or even financial regulation and stability. We should then regard the climate and energy package to represent a core, though the only current legislative package in this field, the climate targets, are now anchored in the key strategic documents such as EU 2020 Strategy, Energy 2020 or

Roadmap to low carbon economy in 2050.

Having put itself in the role of the leader in fighting climate change (e.g. CONCL 1/2009) after agreeing to relatively ambitious binding reduction targets under the Kyoto protocol (for the first and the second phase), the European Union had to find a mechanism ensuring the fulfilment of given targets and curbing the greenhouse gases (GHG) emissions at the least cost possible. From three basic options of doing that on economic rather than control-and-command approach, the Union opted for the concept of emission trading and in January 2005 launched its Emission Trading Scheme (ETS)[2] as the largest multi-country, multi-sector GHG trading system world-wide. The system is a kind of cap-and-trade system, i.e. it is based on a given cap on emissions and trade in emission allowances, thus giving value to reducing CO2 emissions and putting a price on carbon. This is a must, regardless some criticism about functioning of the price setting mechanism. Like in any market, scarcity is crucial to pricing, and a price depends both on the stringency of a cap (the absolute quantity of allowances available) and the demand for allowances and expectations about the future. The most fundamental difference of emissions trading from any normal market is that the amount available depends directly on governmental decisions about allocations; and expectations about the future are largely expectations about future emission targets (Grubb, Neuhoff, 2006).

The new regulatory scheme is deemed to have serious implications for European business and may transform the way business is done in the power and heat sector, as well as in other relevant industries. That is why the authors decided to try to deal with the issue; however, due to clear limits on the data availability they centred their attention exclusively on the case of the Czech Republic. Therefore, the conclusions provided here apply predominantly to the Czech situation, although some of the more general conclusion may be relevant for other EU-27 countries as well. In the same vein, it is likely that some conclusions may be influenced by Czech specificities to the extent that limits their general application for the rest of the EU[3]. In the following text readers will

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2 The scheme is based on Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC, which entered into force on 25 October 2003.

3 Speaking about the issue of data and its gathering, one needs to be aware of specific conditions in the chosen region, namely the transformation and privatisation of industries, short period of "market

find a short description of the model used, the derived conclusions, brief debate of those conclusions and also a link of the issue to the problem of energy market liberalisation.

EU ETS in the Phase II

Model in short

For the purpose of describing the dependence between prices of electricity and emission permits, we established a structural cointegrated VAR model based on the approach proposed by Sims (1980), while simultaneously solving the problem with error terms. Given the underlying behaviour of variables we are investigating and the need for a sound interpretability of the results implying the need for a structural model, we therefore use the structural vector error correction model as follows:

$$B_0 \Delta y_t = \Psi y_{t-1} + \Lambda_1 \Delta y_{t-1} + \Lambda_2 \Delta y_{t-2} \ldots + \Lambda_{p-1} \Delta y_{t-p+1} + C d_t + \varepsilon_t$$

It can be rewritten to its reduced form:

$$\Delta y_t = \alpha \beta' y_{t-1} + \Gamma_1 \Delta y_{t-1} + \Gamma_2 \Delta y_{t-2} \ldots + \Gamma_{p-1} \Delta y_{t-p+1} + D d_t + e_t$$

Where y_t is a vector of endogenous variables[4], α a vector of parameters measuring speed at which the variables approach the long-run equilibrium, β' a vector of estimates for the long run cointegrated relationship between the variables, Γ_p's matrices of parameters for endogenous variables of a given lag, *d* a vector of exogenous variables, i.e. in our case seasonal dummy variables and *D* a matrix of parameters associated with these exogenous variables.

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based" prices of electric energy (as from the March, 5, 2007 the Power Exchange Central Europe was launched) etc that can seriously influence the results of the model and their interpretations.

4 For our modelling requirements, we use three variables that we consider a priori as endogenous (all in EUR): one year forward prices of Czech electricity, one year forward prices of ARA coal (using daily USD/EUR exchange rate), and emission allowance prices. However, it should be stressed that the length of the time series is quite far from being ideal. To prolong the time series, rearward data for additional months until January 2007 were obtained using Hodrick-Prescott filter. To avoid poor performance at ends associated with this filter, a new HP-filtered auxiliary time series running from January 2005 to March 2010 was constructed (with $\lambda = 400$, using both administrative and market prices on daily basis) and the resulting period from January to July 2007 was then appended to the original market-driven time series. Finally, we add seasonal monthly dummies to capture seasonality in each of these variables, which can be potentially detrimental especially while evaluating energy related prices. The final data used in the model runs from January 2007 to March 2010. All calculations were undertaken using the software JMulTi and EViews.

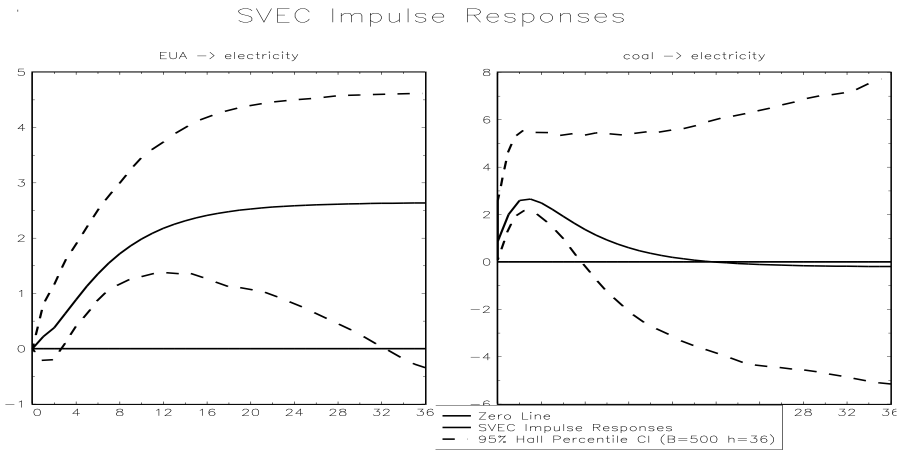
The interpretation of equation (2) is simply that Δy_t can be explained by the error correction term $\alpha\beta' y_{t-1}$ and by lagged Δy_t up to a chosen level, while using seasonal adjustment. Note that y_{t-1} can be explained as equilibrium error that occurred in the previous period: if it is non-zero, the model is out of equilibrium, and vice versa. Applying the model we basically achieved two types of result. When it comes to a long-term co-integration, the estimates are reported in Table 1. All coefficients are statistically significant, which implies that both price of emission permits and coal are crucial to define the level to which electricity price is attracted in the long term. We can also see that all estimates have expected signs. The coefficients themselves can be interpreted as price elasticities, implying that a 1% increase in price of emission permit price would be, in equilibrium, associated with a 1.2% increase in electricity price. Similarly, an increase in coal prices by 1% in equilibrium would raise electricity price by 0.17%. In other words, if we assume that there is going to be an increase in emissions permits price form e.g. €30/tCO_2 to €35/tCO_2, i.e. by 17%, the model calculates the increase in electricity price by 20.4%. Short term predictions about electricity prices can be seen in Figure 2.

Table 1: Cointegrating vector estimates (model with 1 lag)

	$1p_{electricity}$	$– 1.201\ p_{EUA}$	$– 0.172\ p_{coal}$	– 20.958
p-value	[...]	[0.000]	[0.019]	[0.000]
t-value	{...}	{-3.518}	{-2.355}	{-4.704}

Turning to short-term dynamics, Figure 2 presents impulse response functions of 1 EUR price increase shock of emission permits and coal to electricity price. We can see that the increase of emission permit price has a slower onset, but is more persistent than the resulting increase of coal price. The latter one peaks rather quickly after three months, and then fades away. However, since the underlying time series of the used data is quite short, the plotted 95% confidence intervals show that the margin of error is relatively large in both cases and any resulting conclusions should be then taken with due consideration.

Figure 2: Impulse response functions (model with 1 lag)



Source: Simulation of the data in econometric package EViews 7

Economic Interpretation

Using the structural cointegrated VAR model we tried to demonstrate the relationship between electricity prices and EU ETS allowances scheme within conditions of Czech electric energy market. The model has confirmed importance of the EU ETS system introduction as a strong, transparent, environmental and market-based instrument. In the Czech reality the model gives us clear evidence of the strong mutual interdependence of the three variables: **both price of emission permits and coal are crucial to define the level to which electricity price is attracted in the long term**. Thus we can conclude that the carbon pricing is significant and seriously perceived by all stakeholders.

A lot of counter-opinions can be found in this regard, as there is a quite strong criticism on functioning of the ETS. The most common objection is that the basic problem was with the allocation of allowances[5] as well as the methods applied. Initial allocation of EUAs to installations was made through "grandfathering" via national allocation plans (NAPs), i.e. based on historical

[5] The Sandbag organisation even came up with a popular term "carbon fat cats" in order to give a name to the European companies that allegedly made huge profit on the system (so-called windfall profits).

data on emissions or fuel use, limited auctioning (or selling) of allowances (up to 10% of the NAP number). This meant allowances for free[6] and in more than sufficient number (as proved also by a low number of participating Member States in auctioning). Of course there were some benefits concerning the method finally chosen. We can presume that it is conceptually easy to understand and to implement, and no specific infrastructure is needed. It also avoids directly increasing costs for firms and provides political control over the distributional effects of regulations. However, there may also be some adverse effects observed. Such system is inconsistent with "polluter pays principle", diminishes industry's incentives to innovate and the installations covered receive all the scarcity rents. Already the experience from the pilot phase, which was in place from 2005 to 2007, highlighted the drawbacks caused by free allowance allocation. Such allocation intensifies lobbying and can inflate the cap. Repeated free allocation also creates various perverse incentives that undermine the economic efficiency of the scheme. As **Delbeke**, Deputy Director General of the EU's Directorate General for Environment admitted, „*the basic principle has...been to allocate free allowances based on historical emissions, with the negative effect of favouring less efficient facilities*".[7] Even if we agree with the negative effects of the ETS, we have to admit that there was really no other feasible option to move ahead, mostly due to a high sensitivity connected with another possible option – supranational taxation. Moreover, the problem with the allocation method is expected to be solved in Phase III with the abolishment of NAPs and their replacement by an overall EU-wide allocation and introduction of auctioning as default method of initial allowance allocation. From 2013 onwards there shall be initial auctioning share of 100% in the power sector, and of 20% for all other sectors to be increased linearly to 70% by 2020. At the same time, non-auctioned allowances will be distributed on the basis of ambitious benchmarks. Full auctioning to all installations in all sectors will occur by 2027, while some exemptions for energy intensive sectors were agreed. The assumed benefits are improvement of allocative efficiency, increase in public revenues through auctions as it is the government who receive the scarcity rents or greater innovation incentives due to higher costs in the auctioning

[6] Even though in the Czech Republic free allowances are, under some conditions, subject to taxation in the second half of the Phase II.

[7] Jos Debelke, 'Written statement to Hearing by the Senate Committee on Finance on "Auctioning under Cap and Trade: Design, Participation and Distribution of Revenues"', 7 May 2009, p.6.

process. In the model the issue of over allocation or grandfathering did not show itself for two basic reasons: the model did not actually calculate numbers of allowances granted according to NAPs to installations and, via price, took into account only a minor part of them, i.e. those that were traded for speculative purposes and not meant for compliance purposes.

The second result obtained by applying the model closely interacts with the allocation method. It is the issue of internalisation of the externalities coming from fossil fuels burning. Under the European climate change policy, the European Trading Scheme was meant as a main tool to introduce a system that enables the inclusion of those externalities into the price of the final output on the basis of "polluter pays" principle. As we may conclude form the first results, this might not have been fulfilled, as the ETS has passed an increased costs burden from electricity producers to final electricity consumers, i.e. according to a "consumer pays" principle. This can be derived from calculated price elasticities implying that 1 per cent increase in price of emission permit price would be, in equilibrium, associated with 1.2 per cent increase in electricity price and similarly, an increase in coal prices by 1 per cent in equilibrium would raise electricity price by 0.17 per cent. One can argue that it was a logical result of grandfathering, which is in theory often mentioned in this connection. However, in the area of power generation, the issue of passing through is highlighted and in connection with free allowances allocation it is perceived as primary cause of generating the so-called windfall profits – large unearned financial gains as a result of flaws in the rules rather than any proactive measures taken to reduce emissions through structural changes. According to **Delbeke** *"due to its ability to pass on full costs, including the opportunity costs of allowances that were received for free, there were significant 'windfall profits' to the power sector"* (Debelke, 2009, note 7). A solution that shall prevent this from happening would be auctioning. In our opinion it is not so easy and only the issue of windfall profits may be solved. But due to the price sensitivity observed between allowance price and electricity, the passage through is quite strong and will not diminish in future just because of auctioning. A significant increase in price of electricity might be expected, owing to increasing demand and growing cost connected with the transformation of the sector and, consequently, contribution of a pass-through will be less clear.

At the same time, the introduction of the ETS highlighted a mutually interdependent issue, so-called "carbon leakage". This finding holds true namely within the "new" EU Member States (based on the fact that the industrial and power generation base of the Czech Republic is very similar to other countries from the Central and Eastern Europe), where the above-described transmission caused increased energy prices for a number of energy intensive industries. Due to the high interdependency of allowance price and electricity price, sharp increase in the former leading to even sharper increase in the latter will bring about significant indirect costs. Unlike other sectors, affected sectors cannot take the advantage of allowances auctioning and trading in order to compensate for the expected losses and government action may be needed. This slightly disconcerting fact might even double in the future with the introduction of the third phase of the ETS, when the allocation of allowances for free is going to be gradually replaced by allowances auctioning. However, it is frank to say that there was a significant buffer negotiated in favour of the endangered industries[8] and initial results suggest that over half of the 258 industrial sectors assessed so far will be counted as being at risk of significant exposure to international competition, and therefore eligible for free permits (ENDS Europe Daily, 2009). A further provision allows EU Member States to "temporarily compensate certain installations... for costs related to green-house gas emissions passed on in electricity prices, adding a potentially large source of new subsidies for some of the most polluting industries."

To conclude this chapter we may observe that there are some results achieved on the basis of the model than lead to quite strong conclusions about the previous practice and about their possible reflections in the future. On the other hand, we shall be aware that there are some limits both in the construction of the model as well as in the data. Unlike a general equilibrium model, the VAR model is not capable of describing the future developments. On the other hand, the situation about future parameters of the Phase III is still evolving, basic data concerning for instance the amount of allowances for auctioning or size of volumes of allowances to be banked have not yet been announced, and even the already announced figures may change, as demonstrated by the ongoing discussion about having higher European reduction ambitions.

[8] In case of the EU ETS, the ETS Directive foresees that sectors exposed to a significant risk of carbon leakage should receive free allowances at one 100 per cent of the benchmark. The list of those sectors should be determined based on specific criteria outlined in the Directive (COM, 2009).

The EU ETS and liberalisation

Despite of the fact the main focus of the project work was targeted towards the EU ETS interactions within the electricity prices, there still remains several overlaps to concentrate on when assessing the ETS system linkages. The electricity liberalisation counts among them as one of the most important functional framework for setting up electricity prices. Supported by ones, refused by others, the electricity liberalisation represents a trend of development of the energy industry heading towards finalisation of the European single energy market, awaited to be completed by 2015[9].

This link is very strong as electricity generation represents one of major sources of CO_2 emissions. On the other hand, it shall be mentioned that increased competition in the European energy markets resulting from liberalisation trend is effectively affecting the degree of the environmental impact. In this relation, **Mulder** introduces four key factors determining aggregate environmental impact (Mulder, 2006). Apart from liberalisation's impact on electricity consumption, fuel efficiency and fuel mix, liberalisation has also direct impact on the performance of environmental regulation, as pointed out already before by **Brennan** (Brennan, 2002). Following the results of **Mulder's** contribution we realise that if the emission cap is fixed and liberalisation facilitates fuel efficiency and clean technologies, the market will only head towards more available allowances that could be sold to other sectors also covered by the EU ETS. This mechanism, however, already brings some expected results of the ETS introduction and we may consider this case to be a positive example of synergy between liberalisation and CO_2 fighting policy – otherwise said, liberalisation is generally not opposed to environmental objectives and can strengthen the effect of market-based environmental instruments.

Being more specific, some rules of emission allocation can favour investments with high carbon intensity and lead to elevate the price of allowances for given cap in the long term. Consequences of such higher emission allowance prices are, consequently, higher abatement costs in order to meet the reduction targets, jeopardising the generally efficient and effective design of the Emission trading scheme. This could also lead to competitive disadvantages for the EU in comparison to other countries with less strict regulation of CO_2 emissions.

[9] European Council Conclusions of 4 February 2011, EUCO 2/11.

Detailed look at the European allocation mechanisms reveals that different provisions are creating competition distortions in the energy market – in particular distortions among different participants, distortions between participating and non-participating sectors within one Member State as well as between different EU countries. The European trading scheme is, however, functioning within close coexistence with the liberalisation process and the impacts on the electricity sector and the climate are, consequently, results of their mutual interaction. Actually, due to unfinished liberalisation[10] a relevant quantification of their overall effect is hardly feasible. Nevertheless, European stakeholders come out of a common understanding that market-based regulations, such as the EU ETS, are evidently more compatible with more liberalised framework.

Both energy market liberalisation and European policy of CO_2 abatement and climate change have been on the EU agenda for many years by now. As it could be seen in related studies, e.g. in "Liberalisation model for the European Energy Markets" (Aune, 2008) there are even more interactions across these two areas of our interest that already suggested. As proven by Norwegian research team, liberalisation brings ordinarily lower electricity prices for consumers, which is compensated by loss for producers – this welfare gain can be well estimated for different European regions. However, this is but a short-term impact, from longer perspective electricity producers are able to reduce or expand their generation capacity depending on the simulated profitability.

Taking into account mutual interactions of the EU climate policy represented by EU ETS and liberalisation, we can nowadays experience the hybrid system of cutting CO_2 emissions where too many exceptions are embodied as common CO_2 prices are used exclusively by power producers and large industries, while other sectors are subject of different national taxes. Such system is not efficient enough – in order to reach efficiency the Europe should try to approach this situation with almost uniform price of CO_2 emission allowances applied for all sectors in near future. On the other hand, we should constantly take into account the specifics of the liberalisation in every single Member State, because they differ from each other. In the Czech Republic for

[10] Despite the fact that Directive 2009/72/EC concerning common rules for the internal market in electricity requires all Member States to transpose it is unlikely to happen in the most EU Member States.

instance, the liberalisation has reached relatively satisfactory level[11] followed by several positive side effects – growing market integration with neighbouring states or relatively high switching rates of both industry and consumers. Nevertheless, it has its own limits – even after reaching full liberalisation, consumers could benefit from suppliers' competition only on limited scale. For example, in the Czech Republic the final electricity price is composed of two major components: power price, which benefits from all advantages and results of liberalisation and ongoing competition within EU internal energy market, and regulated payments for electricity transmission. These payments consist of price of distribution; price of system services; price for support of electricity buyout from renewable sources and combined electricity and heat production; price for accounting activities of the Electricity Market Operator; and from 2008 also newly stipulated electricity consumer tax[12]. After thorough evaluation of all price components we come to a conclusion that more than 60 per cent of the final electricity price is regulated either by Czech Energy Regulation Authority or by the Ministry of Finance.

Liberalisation of the electricity sector in the European Union is actually accompanied not only with strong relations with other tools of European policies (e.g. the EU ETS), but according to **Percebois** (Percebois, 2008) in particular with two trends which may appear the opposite of what was expected: an increase in price paid by the end consumer on one side and a reinforcement of the incumbent operators' market power, by means of mergers and acquisitions on the other. Electricity price increases are largely due to the fact that the price of fossil fuels serving to produce electricity has sharply increased, but also due to the fact that electricity generators project the acquisition cost of CO_2 permits into the energy price. As a result, due to the interdependence between European electricity markets, some consumers bear a net loss of surplus and electricity price convergence between countries is not necessarily profitable for all consumers. Finally, mergers and acquisitions are consistent with the development of the European internal energy market and with regulatory competition surveillance of both national regulators and the European Commission. Watchdogs should, however, behave sensitively in order not to weaken the position of the European stakeholders against their foreign

[11] European Commission, 2010. „Report on progress in creating the internal gas and electricity market", COM(2010)84 final.

[12] This tax is paid by the electricity supplier to the Customs Administration in bulk for all customers.

counterparts trying to enter the European market.

When providing the interaction between theoretical approaches regarding the liberalisation process on one side and practical findings of our structural CVAR model on the other, we realise that our economic interpretation is becoming more plastic and complex. First of all, carbon pricing is significant and seriously taken by all parties involved while amount of traded emission allowances increases together with deepening of the liberalisation in the Czech Republic. This confirms the idea that liberalisation does not oppose the environmental instruments, but in many ways they are rather complementary. Secondly, despite the major part of the final electricity price being composed of regulated components, we have proven that allowances trading may have significant impacts on consumers through the increased electricity prices because the amount of regulated price components is stable in given period and non-regulated part – power itself – is the only real variable. And, finally, we confirmed our finding that price paid by the final consumer well reflects both increasing price of fossil fuels and carbon prices. Nevertheless, we did not confirm the influence of mergers and acquisitions, as the market situation in the Czech Republic is relatively stable within the entire observed period.

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