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Egor A. Krivosheya

EVALUATING EFFICIENT MULTILATERAL INTERCHANGE FEES: EVIDENCE FROM END-USER BENEFITS

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Egor A. Krivosheya[1]

EVALUATING EFFICIENT MULTILATERAL INTERCHANGE FEES: EVIDENCE FROM END-USER BENEFITS[2]

This article evaluates the efficiency of current MIF rates for the Russian market and identifies the effects of their changes. In order to estimate the demand of end users and end-user surpluses the study uses the adopted version of the Bedre-Defolie and Calvano (2013) model as well as representative samples of 800 traditional (offline) Russian merchants, 1500 Russian individuals and 7 banks from the top 20 that cover more than 80% of the Russian issuing and acquiring markets and the end-user benefits. Results confirm the efficiency of currently set MIF rates. Comparative statics analysis confirms that the changes in MIF rates never lead to a Pareto improvement, while the total surplus changes are asymmetric across different market parts. The article also shows that once the realistic assumptions are introduced to the models (e.g., information asymmetry, imperfect pass-through of changes) the end-user welfare is distorted more severely as a result of the MIF rates changes. The first-best policy for the Russian regulator and legislators is the use of alternative (non-tariff) stimulating measures for a cashless economy in order to isolate the effect of changes to the intended groups.

JEL Classification: G21, D53, E42, L14.

Keywords: Retail payments; payment cards; interchange fees; efficiency; optimal regulation.

[1] Moscow School of Management SKOLKOVO. Financial Innovations and Cashless Economy Centre. National Research University Higher School of Economics. School of Finance. E-mail: Egor_Krivosheya@skolkovo.ru

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1. Introduction

Payment cards have become inseparable from modern life in both developed and developing markets. Although the developed markets are often used as a benchmark for the rest of the world, developing markets have become global leaders both in traditional payment products and in newer solutions like FinTech. The largest shares of payment products usage are achieved in places outside the usual finance leaders, e.g., in Nordic countries or BRICS. One distinctive feature of these markets is the lack of regulatory intervention in the tariff structure in the market that has been historically present in the EU, the USA and Australia, among others.

Rising heterogeneity of the market, however, has put pressure on regulators. In Russia, the discussion around multilateral interchange fee (MIF) rates, the key interbank tariffs paid by acquirers to the issuers that shape the operations on the market, has become more active during the past few years. In particular, as in case of the USA and the EU, where regulation is already in place, merchants started to file complaints and lawsuits more actively. The retail payments market with traditional payment systems in Russia represents a four-sided payments scheme, a version of a two-sided market, where merchants use cashless payment acceptance services from acquirers and individuals use payment products such as payment cards from the issuing banks. MIF rates are paid from the acquirer to the issuer each time a cashless transaction between cardholder and merchant occurs. As a result, MIF rates are viewed as a balancing or stimulating mechanism, which redistributes the costs from acquirers to issuers. Hence, MIF rates also determine the fees or any bonuses associated with cashless payments for merchants and cardholders. Payment systems set fees based on the cost data they get from acquirers and issuers in the payment system. Regulators, however, may impose caps on the size of the interchange fee, trying to stimulate the market or rebalance the fees across the two market sides.

So far, there have been no regulatory changes vis-à-vis MIF rates, however, the Russian regulator monitors the market closely. The question of current MIF rates efficiency becomes more important for Russia and other markets that have not yet seen regulatory tariff intervention. Current weighted average (weights are based on the transaction volume) MIF rates in Russia are approximately 1.75%, however, this figure ranges across different payment products and merchant groups from 0 for utility payments to up to 2.1% for premium payment products in fast food and other segments. Additionally, the issue of the MIF rates changes as a policy tool has become crucial because none of such interventions has proved to

be Pareto efficient yet (Evans, Chang, & Joyce, 2015; McGinnis, 2012; Weiner & Wright, 2005; Krivosheya, Korolev & Plaksenkov, 2015). This may partially be explained by the fact that, as yet, there is no transparent MIF efficiency assessment mechanism.

To address these issues the research puts forward the following key questions: are current MIF rates set in the Russian retail payments market efficient? Are welfare improving changes possible? This study presents the first empirical mechanism of MIF efficiency assessment tailored for Russian market. There is no accepted definition of the efficient MIF rates yet, however, for the majority of the analyses this article concludes that the rates are efficient if there are no ways to achieve a Pareto improvement by changing the MIF rates. In other words, MIF rates are efficient if the changes in MIF rates cannot increase the sum of end-user surpluses without decreasing the surplus of individuals or merchants. Alternative approaches to MIF rates efficiency are also presented and tested in this research.

The same mechanism is also used to address the effect of regulatory changes and proposals before they are implemented to understand the desirability of tariff interventions for Russia. It may serve as a tool for the practitioners and academics to price the payment products more fairly as well as to assess the changes in market terms for various agents' groups. Moreover, it helps to get additional insights into the Russian retail payments market and to understand better the behavior of end users as well as to find methods of transition to a better version of a cashless economy in a more efficient way.

This article aims to contribute to two rising strands of literature. The first one concerns the efficiency of MIF rates and the effect of regulatory initiatives (Baxter, 1983; Bedre-Defolie & Calvano, 2013; Guthrie & Wright, 2007; Rochet & Tirole, 2002, 2003, 2006, 2011; Valverde, Chakravorti, & Fernández, 2015; Verdier, 2011). This literature either provides the theoretical models that compare the efficiency of MIF rates set by different agents (e.g., regulators vs payment systems) or analyzes the ex-post effects of regulatory initiatives. Theoretical models usually ignore empirically established facts about end-user behavior (e.g., strategic card acceptance by merchants, information asymmetry in the market) despite providing the baseline models for the market analysis based on the end-user benefits. At the same time, theoretical models serve the basis for regulatory initiatives (e.g., Jonkers, 2011). In practice the cost-based models dominate decision making about MIF rates which do not allow the economic principles of the market formation to be captured to the necessary extent. Empirical research does not allow for preventive analysis of the MIF rate changes, it can only assess the efficiency of the effective regulation, in other countries especially, without offering any detailed insight into the efficiency of future policies. This research aims to fill this gap by

evaluating the efficiency of current MIF rates in Russia and assessing (ex-ante) the effects of potential changes in MIF rates using the empirical benefits-based mechanism, which captures both economic principles established in theoretical models and the empirical facts that have not yet been properly modeled. After analyzing the literature, this is the first study to propose an ex-ante evaluation of current MIF rates efficiency and an analysis of the effect of its changes on the market participants' welfare.

Additionally, this research contributes to the growing empirical literature on the emerging retail payments markets (e.g., Reinartz, Dellaert, Krafft, Kumar, & Varadarajan, 2011) by analyzing the current market situation and identifying the merchant-related stylized facts of the retail payments market in Russia. Besides, this study provides a comparison between the determinants of merchants' benefits and the determinants of probability of acceptance of payment cards.

The empirical analysis of the MIF rates efficiency uses representative samples of 1,500 individuals, 800 traditional (offline) merchants from all Russian regions and 7 banks (all from the top 20) that cover more than 80% of the issuing and acquiring markets in Russia. The method is based on the adopted version of the Bedre-Defolie & Calvano (2013) model, which was used as a basis for the European MIF rates regulation and incorporates most of the major results established in previous models. The study finds significant robust evidence in favor of the current MIF rates efficiency. Changes in MIF rates result in welfare destruction for the end-user groups. Whilst Pareto improvement never occurs, the total surplus increase may be achieved. For most of the analysis the former happens when MIF rates are increased rather than decreased, however, it broadens the gap between merchants' and cardholders' benefits. However, total surplus increases are not robust across different parts of the market and, therefore, may not happen or may result in additional losses that were not revealed by the theoretical analysis. Additional analysis of the effect of changes not only for the average end users but also for the median end users shows the vulnerability of some end-user groups to changes and the fragility of the current state of the Russian retail payments market. The results are robust to changes in measures, methods and sample.

Assumptions easing leads to even more detrimental effects on the total surplus as well as individual surpluses of the agents. Imperfect pass-through of the favorable changes by banks may result in welfare distortions. Also, information asymmetry may lead to a decrease in the competition in the retail market. MIF rates changes have wider effects and may result in a welfare decrease for cardholders or merchants that already accept and use cashless methods. Due to wide adoption and the strategic nature of acceptance, changes in MIF rates may also

result in changes in the market structure of banking and the retail market, changes in retail prices as well as the loss of benefits of a cashless economy (e.g., increased security and transparency, increased speed of transactions and higher development) (Plaksenkov, Korovkin & Krivosheya, 2015). The findings in this article highlight the importance of empirical ex-ante evaluation of the changes in MIF rates and imply that the first best policy is the use of the alternative (non-tariff) methods of cashless payments stimulation.

Following this introduction, section 2 gives a review of relevant literature and outlines the key elements of the theoretical model that is used later for the empirical estimations. Section 3 explains the empirical set-up of the research and the method of MIF efficiency evaluation as well as the mechanisms for comparative statics analysis. Section 4 presents major findings. Section 5 presents the results of the supplementary analysis for the asymmetric interactions between different end-user groups and for the estimations using direct merchants' benefits. Finally, section 6 discusses the results, explains limitations, suggests directions for future research and concludes.

2. Theoretical framework

2.1. Related literature

Literature on MIF rates efficiency breaks into two key streams: theoretical models of the market equilibrium formation and regulatory vs. payment systems' choices, and the ex-post empirical analysis of the effects of introduced regulations and laws. There are no empirical mechanisms for the ex-ante analysis of the regulatory intervention in the retail payments market. Due to the lack of such mechanisms regulators must rely purely on theoretical predictions or refer to international experience (Evans et al., 2015; Gans & King, 2003; McGinnis, 2012; Wang, 2013). The former largely depends on the assumptions and depending on those can produce different results (e.g., Rochet & Tirole, 2003 and Wright, 2004 conclude that there is no systematic shift of the MIF rates set by the payment systems from the efficient ones, while Bedre-Defolie & Calvano, 2013, Rochet & Tirole, 2002 and Guthrie & Wright, 2007 conclude that the existing rates are likely to be higher than or equal to the optimal ones). All of the assumptions cannot be included simultaneously due to the computational difficulties and variation in the payments industry specifics (e.g., degree of market power by banks, heterogeneity of merchants' and cardholders' benefits, elasticity of

end-user demand). At the same time, empirical ex-post analysis of the initiatives is only partially helpful for decision making because of the dynamic nature of the market (demand, products and behavior changes with time) and local institutional aspects (Evans & Mateus, 2011; Valverde et al., 2015)).

Besides, despite theoretical models of the industry formation incorporating end-user benefits and demands for the services, there are, as yet, no empirical estimates of end-user demand curves (Evans, Litan, & Schmalensee, 2011; Evans et al., 2011). The lack of such estimates shifted the focus of regulators, practitioners and academia towards the cost-based models, which do not incorporate the economics of the market to a necessary degree (Evans et al., 2011; Gans & King, 2003; McGinnis, 2012; Rochet & Tirole, 2006; Rochet & Wright, 2010; Wang, 2013). However, the benefits of the end users were recently estimated for the Russian market (Krivosheya & Korolev, 2016, 2017).

This gap in the mechanisms of MIF efficiency analysis led to three key types of inefficiencies. Firstly, no welfare improving regulatory MIF cut has yet been introduced (Krivosheya et al., 2015; Weiner & Wright, 2005). This may be due to the fact that MIF rate cuts are never efficient or because the regulators failed to produce efficient regulation due to the lack of information or mechanisms for such regulation. Secondly, commercial agents focus on the cost-based methods for payments products pricing rather than the benefits-based ones, which may also produce distortions to the end users welfare. Thirdly, wider economic effects of MIF regulation such as the change in payments market structure as well as additional market imperfections such as imperfect changes pass-through or information asymmetry are often ignored.

Against this theoretical background, this study reviews the debates around the MIF rates efficiency proposed in the theoretical literature and outlines the reasons for potential differences in the set MIF rates and efficient ones and the grounds for optimal regulation. Also, the article offers an overview of the regulatory initiatives and the literature assessing the ex-post effects of such interventions. Finally, the theoretical model used for the empirical analysis, as well as some important definitions and criteria of which MIF rates are considered efficient, are introduced.

2.1.1. Efficient vs. chosen MIF rates

MIF rates have two roles in the retail payments market. Firstly, they balance the costs between issuers and acquirers (Baxter, 1983). In the four-sided payments scheme the negotiations between the participating acquirers and issuers would be costly to settle, and therefore unified MIF rates are introduced. Schmalensee (2003) and Wright (2004) extend this result by defining the MIF rates as a balancing instrument for the end-user demand as the costs redistribution affects the tariffs and quality of services offered by banks. Secondly, the MIF rates have a stimulating role: higher rates lead to smaller net costs of payments business for issuers, which leads to more attractive services to cardholders, while lower fees make the cashless payments acceptance more attractive to merchants. As a result, MIF rates may be used as a key instrument for the payment systems to achieve their goals: they can choose MIF rates maximizing the total surplus of the industry, maximizing the profits of acquiring and issuing banks or maximizing the transactions volume or value.

Most of the studies conclude that the efficient rates differ from those chosen by payment systems (Bedre-Defolie & Calvano, 2013; Guthrie & Wright, 2007; Rochet & Tirole, 2002, 2003, 2011; Rochet & Wright, 2010; Verdier, 2011). The efficient rates are defined as rates that maximize total value or surplus in the payments market. Herein, the terms efficient and optimal MIF rates are interchangeable. This study follows Bedre-Defolie & Calvano (2013) in order to determine socially and privately efficient MIF rates. Privately efficient MIF rates maximize the surplus at one side of the market (i.e., the buyers efficient MIF rates maximize cardholders' surplus from using cashless payment instruments, while the sellers efficient MIF rates maximize the sellers' surplus). Socially efficient MIF rates maximize the total surplus of all agents on the market.

There are four key factors that affect the differences between efficient and chosen MIF rates (see, for instance, Evans et al., 2011, Humphrey, 2010, Rochet & Tirole, 2011, or Verdier, 2011 for extensive review of the theoretical models comparing set and efficient MIF rates). Firstly, the distribution of market power between acquirers and issuers as well as the degree of changes pass-through to final merchants affect the chosen MIF rates. If markets are imperfectly competitive and the MIF rate changes are expected not to be perfectly passed through to the end users, the difference between the efficient and chosen MIF rates increases (Bedre-Defolie & Calvano, 2013; Evans et al., 2011; Hasan, Schmiedel, & Song, 2012; Jonker, Plooij, & Verburg, 2017). Secondly, the higher degree of competition between the

payment systems makes the chosen MIF rates less close to efficient ones as the competition is based around the issuing side of the market that stimulates the transaction volume (Chakravorti & Roson, 2006; Guthrie & Wright, 2007; Rochet & Tirole, 2003).

Thirdly and fourthly, the degree of merchants' heterogeneity (the heterogeneity of merchants' benefits) as well as the strategic nature of card acceptance (the degree towards which the merchants' decision to accept cards affects consumers' choice of retailer) influence the size of the gap. The strategic nature of merchants' card acceptance leads to higher than optimal MIF rates (the chosen rates are larger than the cost-balancing ones by the value of the average cardholders' benefits) (Bedre-Defolie & Calvano, 2013; Rochet & Tirole, 2002). Merchants' heterogeneity, in theory, may lead to both higher or lower than efficient MIF rates. The result depends on the relative price elasticities of merchants' and cardholders' demands (Bedre-Defolie & Calvano, 2013; Rochet & Tirole, 2003; Wright, 2004). Rochet & Tirole (2003) demonstrate that the chosen MIF rates are higher than the efficient ones if average net benefits of merchants are lower than the average net benefits of cardholders. Comparing the results of the Krivosheya & Korolev (2016) with Krivosheya & Korolev (2017), that provide estimates of net end-user benefits for the Russian retail payments market, shows that the average net benefits of merchants are higher than the average net benefits of cardholders. According to Rochet & Tirole (2003), this would mean that the MIF rates are likely to be lower than the efficient ones. However, this result needs further formal testing as the Rochet & Tirole (2003) model ignores other real-life assumptions relevant for the retail payments market (e.g., strategic acceptance).

2.1.2. Regulatory MIF cut effects & efficiency

The theoretical models for payments industry formation and efficient MIF rates propose regulatory intervention in the market in cases where the gap between the chosen and efficient rates is confirmed (Bedre-Defolie & Calvano, 2013; Chakravorti & Roson, 2006; Rochet & Tirole, 2002, 2003, 2011; Wright, 2004). Ever since the NaBanco v. Visa (1979) case all lawsuits, regulatory initiatives and legislation have been aimed at MIF rate cuts (e.g., Carbo-Valverde & Liñares-Zegarra (2012) and Weiner & Wright (2005) provide an overview of historical MIF rate regulation). None of such interventions has, as yet, been found to be welfare improving (Weiner & Wright, 2005; Krivosheya et al., 2015).

There are three key reasons for MIF regulation. First, too high MIF rates may lead to the increase in prices (Chang, Evans, & Garcia, 2005; Evans, 2011; Evans et al., 2011; Malaguti & Guerrieri, 2014; Weiner & Wright, 2005; European Commission, 2013). Merchants perceive the fees as one of the components of business costs and incorporate any changes in merchant discount fees into the pricing decisions to get the desired level of margins (C. Arango & Taylor, 2008; Bolt & Mester, 2017; Bounie, François, & Hove, 2016; Evans & Mateus, 2011; Loke, 2007; Snellman, Vesala, & Humphrey, 2001). However, this argument becomes less relevant once merchants' competition is assumed because competition among merchants forces them to lower the prices while providing the convenience in terms of payment choices for consumers (C. Arango & Taylor, 2008; Krivosheya & Korolev, 2017; Loke, 2007; Rochet & Tirole, 2002).

Secondly, the no-surcharge rule leads to the fact that the users of less costly payment methods (e.g., cash or debit cards) subsidize the users of more expensive methods (e.g., credit cards) (Jonkers, 2011; Malaguti & Guerrieri, 2014; Snellman et al., 2001; Weiner & Wright, 2005). Cardholders do not pay variable fees for card usage and, therefore, use expensive payment methods too often lowering the total welfare in the market. Thirdly, banks participating in the payment card associations (systems) focus on profit maximization and benefit from higher MIF rates. For most of the markets the issuing side of business is less competitive than the acquiring side, which leads to imperfect pass-through of the costs and revenues to the cardholders' terms of service (Evans & Mateus, 2011; Hasan et al., 2012). Besides, many banks are both acquirers and issuers, which leads to the existence of the on-us operations that are less affected by the MIF rates (Malaguti & Guerrieri, 2014).

MIF rates regulation is aimed at reducing the inefficiencies described above. There are two key approaches to the determination of the degree of regulatory intervention. The most widely used is based on cost balancing (Carbo-Valverde & Liñares-Zegarra, 2012; Chang et al., 2005; Evans, 2011; Evans et al., 2011; Jonker et al., 2017; McGinnis, 2012; Wang, 2013; Weiner & Wright, 2005). MIF cuts based on this method led to the increase in fixed cardholders' fees and reductions in loyalty programs on the cardholders' side (Chang et al., 2005; Krivosheya et al., 2005; Evans, 2011; Wang, 2013; Carbo Valverde et al., 2016). On the acquiring side of the market the decreases in merchant discount fees (even with perfect pass-through) did not led to a significant price decrease, but increased the profitability in the retail industry (Chang et al., 2005; Hasan et al., 2012; Valverde et al., 2015; Weiner & Wright, 2005). The number of cards issued under the three-party payment schemes (e.g., American Express, Diners Club) that were not affected by MIF regulation increased (Chang et

al., 2005). Overall, the cardholders' welfare is usually reduced in case of the regulation, while the increase in merchants' welfare is usually not enough to offset the loss on the consumers' side (Carbo-Valverde & Liñares-Zegarra, 2012; Chang et al., 2005; Evans, 2011; Evans et al., 2015; Jonker et al., 2017; McGinnis, 2012).

The other method is based on the tourist test (Bolt, Jonker, & Plooij, 2013; Jonker & Plooij, 2013; Rochet & Tirole, 2011; Zenger, 2011). According to this test the merchant should be indifferent to accepting cards or cash from a random tourist. In the theoretical models this leads to welfare improvement (Rochet & Tirole, 2011; Zenger, 2011). In practice it was implemented in the EU and brought the results that were similar to the cost-based regulation (Bolt et al., 2013; Bolt & Mester, 2017; Carbo-Valverde & Liñares-Zegarra, 2012; Evans et al., 2011; Evans & Mateus, 2011). In particular, the cardholders' fees were changed, while the payment cards acceptance did not change significantly (Carbo-Valverde & Linares-Zegarra, 2012). At the same time the average volume decreased, while the average transaction value increased (Ardizzi, 2013; Bolt et al., 2013; Carbo-Valverde & Liñares-Zegarra, 2012; Snellman et al., 2001).

Inefficiencies of current regulation can be addressed by the empirical models of ex-ante analysis of the regulation. Rochet & Tirole (2011) justify the tourist test with merchants' homogeneity. Under heterogeneity assumptions the demand characteristics should be included in the MIF rates choice (Evans et al., 2011). Besides, wider economic effects and market imperfections such as strategic acceptance, platform competition, information asymmetry, imperfect pass-through and the changing market structure need to be incorporated in a MIF related decision, making it more difficult to estimate accurately efficient MIF and efficient regulation (Evans et al., 2011; Evans & Mateus, 2011; Rochet & Tirole, 2011; Schmalensee & Evans, 2005; Tirole, 2011). These imperfections are either explicitly or implicitly captured in empirical estimates of end-user benefits (Krivosheya & Korolev, 2016, 2017).

2.1.3. MIF and regulatory efficiency criteria on functioning markets

Although socially efficient MIF rates discussed extensively in the literature might provide a useful benchmark for a theoretical analysis of the market that is planned to be established, within the framework of already functioning payments industry it is also important to understand how any changes to existing MIF rates affect the existing welfare

distribution and the welfare of each agent group. To analyze the effect of changes for the composition of welfare within the industry I have introduced a notion of Pareto efficient MIF rates, i.e. the rates deviation from which will result in a welfare decrease for at least one end-user group. Due to the lack of incentives or mechanisms for individuals to compensate merchants, the Kaldor-Hicks efficiency criterion is not applicable.

The Pareto efficient MIF rates are based on the arguments from the empirical literature in the analysis of the effect of regulation. This literature concludes that the regulation fails because some of the end-user groups are hurt despite the fact that the other groups might have benefited from the regulation more than these groups have lost (Chang et al., 2005; Evans, 2011; Evans et al., 2015; Jonker et al., 2017; McGinnis, 2012). Total welfare maximization arguments, as well as the individual optimality conditions, are usually manifested by the theoretical models (Bedre-Defolie & Calvano, 2013; Chakravorti & Roson, 2006; Rochet & Tirole, 2002, 2003, 2011; Wright, 2004).

Switching from total welfare arguments to Pareto improvement analysis may provide a better treatment of the market imperfections and regulatory inefficiencies discussed in the previous section. If the increase in surplus of one group does not lead to a decrease in welfare for the other customer group, then the changes in retail prices that are required to offset the adverse changes for cardholders are no longer needed for the total welfare improvement, and regulatory initiatives may become efficient.

Pareto improvement implies social welfare improvement: if one party can be made better off without making any other parties worse off, the total welfare must increase by definition. The converse is not true. At the same time, Pareto improvement implies private welfare improvement. Social efficiency and private efficiency without Pareto efficiency are not directly related. Therefore, this study uses the following forms of efficiency:

a) MIF rates are called weakly efficient if they satisfy private efficiency at least on one side of the market
b) MIF rates are semi-strong efficient if they are socially efficient
c) MIF rates are strong efficient if they are Pareto efficient

In most of this research the strong form efficiency is tested, however, the semi-strong-form and weak form efficiencies form the basis for the theoretical model presented in the subsequent part. Semi-strong form efficiency is also analyzed in the empirical part of the research. Depending on the goals of the regulator and the bargaining and lobbying power by individual market agents, different forms of efficiency might be targeted by the regulation.

However, in the competitive democratic markets regulators aim to protect the fair distribution of welfare, hence, this research focuses on strong form efficiency of MIF rates.

2.2. Theoretical model and hypotheses

2.2.1. MIF identification model

This study follows the adopted version of the Bedre-Defolie & Calvano (2013) model for the assessment of the MIF efficiency and the analysis of the retail payments market formation. Firstly, Bedre-Defolie & Calvano (2013) model served the basis for European regulation of the MIF rates (European Comission, 2013). Secondly, the model accounts for the results found in the baseline analyses introduced previously (e.g., Bedre-Defolie & Calvano, 2013; Rochet & Tirole, 2002, 2003, 2011; Baxter, 1983; Guthrie & Wright, 2007) and incorporates the less stringent set of assumptions simultaneously, such as strategic acceptance and imperfect competition of banks. Overall, although the model does not reflect the real-life situation in the retail payments market in full, the estimates obtained from the model fit may be applicable to real-life analysis and, hence, provide a good starting point for building the theory-based empirical mechanism of the assessment of shocks and regulatory MIF changes.

The model is set as follows. First, payment systems or a regulator set the interchange fee (a). Then, after observing the MIF rates issuers and acquirers set the respective cardholders' (f, F) and merchants' (m, M) fees. Merchants and cardholders, then, observe their fixed benefits (B_S & B_B), decide on the participation in the retail payments market and choose the bank. Then, merchants set the retail prices and cardholders as well as merchants recognize their variable benefits (b_B & b_S) and choose between cash and cashless payments. The model is solved by backward induction.

In the beginning, we redefined the quasi-demand for card usage by cardholders based on the Bedre-Defolie & Calvano (2013) definitions. Since the net benefits incorporate both the gross benefits and any variable (per transaction) fees imposed by banks, we can write down the following: $D_B \equiv Pr(b_B \geq f) = 1 - G(f) = 1 - J(b_B - f)$ where f is the variable fees imposed by issuing bank (allowed to be negative in case of loyalty or other reward programs), b_B is the variable benefit of a cardholder per transaction and J & G are CDF functions. Under Bedre-Defolie & Calvano (2013) assumptions, all of the benefits functions

are distributed on some compact interval with smooth atomless CDF that satisfies the increasing hazard rate property (IHRP). Unlike in Bedre-Defolie & Calvano (2013), we use the CDF of net benefits directly as shown by the final part of the equivalences above and below.

Quasi-demand for card acceptance is similarly $D_S \equiv Pr(b_S \geq m) = 1 - K(m) = 1 - L(b_S - m)$, where m is the merchant discount fees imposed by acquiring bank, b_S is the variable per transaction benefit of a cardholder and K & L are CDF functions. Otherwise, the model is equivalent to that of the Bedre-Defolie & Calvano (2013) and privately efficient MIF rates are defined in the same manner. The key solution of the model is the set of buyers-efficient MIF, a^B, sellers-efficient MIF, a^S and volume-transaction maximizing MIF rates, a^V are respectively[3]

$$a^B \equiv \underset{a}{\text{argmax}} BS(a) = v_B(f^*)D_B(f^*)D_S(m^*)Q(F^*, f^*, m^*) + \int_{F^* - \Phi_B(f^*, m^*)}^{\overline{B}_B} xh(x)dx$$

$$a^S \equiv \underset{a}{\text{argmax}} SS(a) = v_S(m^*)D_B(f^*)D_S(m^*)Q(F^*, f^*, m^*)$$

$$a^V \equiv \underset{a}{\text{argmax}} V(a) = D_B(f^*)D_S(m^*)Q(F^*, f^*, m^*)$$

Notations, timing and assumptions are preserved from Bedre-Defolie & Calvano (2013). We similarly assume that there is continuum (mass one) of the cardholders and merchants and that market power is at the issuing side of the market, while acquirers are perfectly competitive (these assumptions are relaxed later).). $v_B(f^*)$ and $v_S(m^*)$ are respectively the buyers' and sellers' average surpluses (i.e., net benefits) from card usage under the given fees f* and m* set respectively by issuers and acquirers. $Q(F^*, f^*, m^*)$ is the number of cardholders at the set fees level. Finally, $\Phi_B(f^*, m^*)$ is the expected value of the cardholders' option of being able to pay by card at the point of sale. As proven in Bedre-Defolie & Calvano (2013) $a^S < a^V < a^B$. We use these results to estimate the aggregate surpluses at every end-user side and assess the effect of changes in MIF rates on these surpluses as well as the volume of transactions.

Due to the balancing role of the MIF, assuming the perfect pass-through of the changes in MIF rates by banks to the end users, an increase in MIF rates will results in $v_B(f^*)$ decrease and $v_S(m^*)$ increase due to similar changes in fees set in banks. The converse is true for a MIF rates increase. Therefore, in case of a MIF rates cut, the Pareto improvement is possible only if the decline in cardholders' demand for card payments and net benefits are

[3] Detailed derivations of these surpluses as well as the complete model for payments industry is presented in Bedre-Defolie & Calvano (2013).

offset by the increase in the merchants' acceptance network (i.e., if the decrease in usage demand and benefits is offset by the positive indirect network effects). This allows us to derive the condition for the Pareto improvement (or strong form efficiency improvement) to exist: the MIF rate change should be such that the indirect network externalities offset in magnitude the decline in demand and net benefits size.

Although there are no formal tests on the magnitude and significance of the network effects in the Russian retail payments market, the preliminary analysis shows that the current Russian market situation is fragile and the changes may result in detrimental effects for both end users and overall volume of transactions (e.g., Krivosheya & Korolev, 2016, 2017; Plaksenkov et. al., 2015; Krivosheya et al., 2015). The fragility of the current market equilibrium might result from high elasticity of demand of the end users, especially the adverse changes to the existing fees or stimulating programs, which means that no Pareto improvement is possible. Combining it with the Rochet & Tirole (2003) analysis of the relative size of end-user average surpluses, as above, the first hypothesis of this study is therefore:

H1: Current MIF rates are strong form (Pareto) efficient

2.2.2. Optimal regulation and socially efficient fees

Socially (semi-strong form) efficient MIF rates identified in the Bedre-Defolie & Calvano (2013) maximize the total welfare in the industry. The socially efficient MIF rates are defined as the solution to the maximization problem, where the objective function is the sum of the total end-user benefits. The first-best (Lindahl) interchange fees equate the average buyers and sellers surpluses ($v_S(m^{FB}) = v_B(f^{FB})$). However, this case might not be empirically relevant because, in reality, industry is operated by the payment systems (card associations) seeking to guarantee profitability of payments business for issuers and acquirers. Bedre-Defolie & Calvano (2013) impose an additional constraint of non-negative profits for the banks on both market sides. This analysis results in a higher MIF rate, yet, smaller than purely cost-balancing MIF rates.

In order to achieve strong-form efficiency we impose additional constraints $\frac{\partial BS_0}{\partial a}, \frac{\partial SS_0}{\partial a} \geq 0$, where BS_0 and SS_0 are respectively the buyers' and sellers' surpluses under existing (equilibrium) interchange fees. In this case, it is possible to show that the conditions for the Pareto improvement are more stringent than the conditions for social welfare

improvement. In fact, for the Pareto improvement to occur, the imbalances between the average benefits values on different sides of the market (cardholders and merchants) should be relatively large. For the social optimum to occur it is enough to have the improvement in the benefits of one group as large (in absolute terms) as the loss of the other group. For the Pareto improvement to occur the sufficient condition is that the sum of network externalities at different market sides should be positive. However, once the assumptions are relaxed the analysis becomes more complicated and this sufficient condition might not be enough and elasticities of end-user demand would provide a more accurate analysis of the effect of changes. This study proposes the following:

Proposition 1: Difference in elasticities of demand of cardholders and merchants should be larger for the Pareto improvement to occur than the difference in elasticities needed for the social (total) welfare improvement.

Proof: See appendix.

Since the average benefits value found in Krivosheya & Korolev (2016, 2017) is not equal for merchants and individuals total welfare improvement might exist if the surplus is relocated from the cardholders' side of the market to the merchants. Even though it will not be optimal regulation under the definitions proposed in this study, it is worth considering changes in total surplus to compare the results in this study with theoretical models. Note however, that market imperfections which are not included in the theoretical models are likely to exist in the Russian retail payments market as well (Krivosheya et al., 2015; Plaksenkov et al., 2015; Chernikova, Faizova, Egorova, & Kozhevnikova, 2015). That is why, the difference in average values of benefits is likely to be explained by the market imperfections and, hence, MIF cuts are unlikely to produce semi-strong form improvement. The second hypothesis is, therefore:

H2: Total welfare does not improve with MIF rates changes

The effect of changes is unlikely to be symmetric across the market. First, the banks with a larger share of on-us operations are affected less by the changes in MIF rates (Malaguti & Gaerrieri, 2014). Therefore, such banks may pass through a smaller share of changes in costs to end users (Ahuja, 2008; Interim report on payment cards, 2006). The banks with a larger share of on-us operations are likely to be large market players with a wide network of clients on both sides of the market and, hence, are likely to have larger profitability (Hasan et al., 2012; Kay, Manuszak, & Vojtech, 2014). Therefore, changes in MIF rates are likely to have a larger impact on the banks with a lower share of on-us operations.

H3: The effect of MIF changes is higher for an end-user of banks with a lower share of on-us operations

Finally, the heterogeneity among end-user groups is also likely to produce asymmetric results across different market groups. Benefits size links to the behavior in the retail payments market (Krivosheya & Korolev, 2016, 2017). Besides, the lower income cardholders are less likely to participate in the retail payments market and are more vulnerable to changes (Arango, Huynh, & Sabetti, 2011; Bounie, François, & Hove, 2016; Ching & Hayashi, 2010; Khan, Belk, & Craig-Lees, 2015; Koulayev, Rysman, Schuh & Stavins, 2016). Similarly, smaller and less profitable merchants are more vulnerable to changes (Bounie, François, & Van, 2016; Jonkers, 2011). Preliminary analysis of the end-user benefits shows that benefits size correlates with income and merchant size; and translates into the payment frequency (Krivosheya & Korolev, 2016, 2017). Therefore, the effect of changes for these groups is likely to be more detrimental:

H4: The effect of MIF changes is asymmetric across the market

H5: End users with smaller benefits value are affected more than other groups

3. Empirical set-up

3.1. Data

The finance, payments, and e-commerce chair has generously provided the private data from the national retail payments study conducted in 2013–2014. The representative study for the retail payments market in Russia includes the survey of 1,500 individuals, 800 traditional (offline) merchants and 7 key banks from the top-20 banks in Russia that cover 80% of the issuance and acquiring services offered to end users. The survey of banks focuses on the costs and revenue structure of acquiring and issuance to analyze profitability and MIF roles.

The survey of individuals covers the individuals' profiles focusing on their behavior in the retail payments market. The sample includes individuals, of 18 years of age or older, from cities with at least 500,000 inhabitants. Quotas for age and gender and three-stage probability sampling are used to ensure that the proportions of each distinct group of individuals (by gender, income, age and geographical area) correspond to Russian demographics.

The representativeness of merchants' survey of the whole of the Russian retail payments market has been ensured by including all regions and using quotas for the shop types. The sample focuses on the traditional (offline) merchants only because this segment was the largest in terms of payment activity as of the date of the survey.

The entire dataset is collected using face-to-face interviews with merchants and individuals. The information on the bank costs and revenues is collected using a self-filled questionnaire. Preliminary results were further tested using in-depth interviews with retail payments market experts (e.g., payment systems representatives, regulators, merchants, issuing and acquiring banks, independent experts). All questionnaires focus on payment behavior and include a counterfactual experiment to enable the effect of changes and comparative statics analysis to be assessed. The results of the counterfactual experiment are used to support the results of the analysis in this research. This study also uses the individuals' and merchants' benefits estimates, calculated using the samples mentioned above, as presented in Krivosheya & Korolev (2016, 2017).

The resulting samples comprise 800 merchants, 1,500 individuals and 7 banks. 51% of the merchants accept payment cards. This share varies from 30% in smaller merchants to 92% in larger merchants (such as supermarkets). The most popular merchant types are stalls and kiosks (26.26%) and specialized non-food stores (13.56%). Hypermarkets and supermarkets account for 5.18% of the sample; pharmacy stores constitute 7.4% while specialized food stores constitute 4.81%. Most of the merchants sell food products and beverages (54.75%). 10.11% of merchants sell durable goods and 7.03% of stores sell clothes and shoes. These figures correspond to official Russian government statistics and analytics. The mean experience of accepting cards is 2.34 years., Women account for 44.4% of the individual's sample. 26.7% of individuals are from Moscow and 11.3% from Saint-Petersburg. About 73.5% of the individuals hold at least one payment card, 75% of which pay by card for goods and services. The sample of banks also allows banks with large and small share of on-us operations to be identified. The bank is considered a bank with a large share of on-us operations if it has a share of on-us operations larger than the sample average share.

3.2. Benefits evaluation method

This article uses the benefits estimates for individuals outlined in Krivosheya & Korolev (2016) and for merchants outlined in Krivosheya & Korolev (2017) that employ the

same samples used in this research. Detailed description of the resulting heterogeneity and other details on the methods and evaluated benefits are available in the papers. Variable cardholders' benefits are estimated as follows. The monthly retail transactions volume per capita is obtained from official statistics. Then the number of store visits and the volume of electronic payments (share of card payments multiplied by the volume of retail transactions) is calculated. After that the number of store visits ending with a card payment and the average electronic check are estimated. The benefits are obtained by dividing the latter value by the transactions volume. Also, the version of gross benefits is calculated by the subtraction of the loyalty program rewards.

Benefits of the merchants are estimated using the self-reported total costs of acquiring services available from surveys. Krivosheya & Korolev (2017) use the Luenberger (1992) duality to translate total costs to total benefits value. This value is then divided by the total merchant's transaction volume to obtain benefits as a percentage of transaction. Russian ruble equivalent is available if the per transaction benefit is multiplied by the value of the average check. The study also distinguishes between merchants' direct and opportunity benefits. Opportunity benefits are defined as the transaction volume that would be foregone if the merchant does not accept payment cards and is particularly important in the strategic considerations of merchants' acceptance. These benefits are calculated by multiplying the average probability of choosing the shop based on card acceptance in the region and the merchant's transactions volume that is generated via cards.

Fixed cardholders' benefits are based on the descriptive statistics of the self-reported cardholder fees available from the surveys. The self-reported values are also corrected for the cut-off fees level that represent the maximal fees that the cardholder is willing to pay for issuing payment cards. These fees are then used in the 1000 simulations of the samples of 1 million observations to obtain the gross benefits distributions. Then, the bank fees levels are assigned and the ideal fees, assuming perfect discrimination of cardholders by banks, are calculated across five types of payment products: salary, electronic, standard, gold and platinum cards. To account for the market imperfections that prohibit perfect discrimination the probability of cardholder moving from the ideal product to the neighboring groups is added. The net benefits are calculated by subtracting the resulting fees level from the gross benefits.

Other statistics relevant for the analysis such as the share of accepting merchants, the share of the cardholders in Russia, the bank costs and revenues, the levels of MIF rates and transaction volumes are available from the surveys and public sources (e.g., Rosstat, the

Central Bank of Russia). Descriptive statistics of the benefits and other key variables used in the analysis are presented in table 1. The resulting benefits allow the heterogeneity of end users to be captured as well as the market imperfections that may affect end-user behavior (such as information asymmetry, imperfect competition, etc.).

Tab. 1. Descriptive statistics and the values of key variables

	Value			
	Mean	Median	Min	Max
Individuals variable benefits	7.70%	1.09%	0%	200%
Merchants total benefits	16.34%	5.00%	0.02%	103.16%
Merchants direct benefits	1.56%	-4.65%	-39.43%	82.81%
Cashless transactions value	5 176 billion RUR			
Share of accepting merchants	51%			
Share of cardholders	75%			
Share of cardholders who pay with cards	74%			
Currently set MIF rates (all banks, all products)	1.75%			
Currently set MIF rates (subsample of banks without large share of on-us operations, all products)	4.15%			
Average check	550 RUR			
Fixed individuals benefits	247.7 RUR			

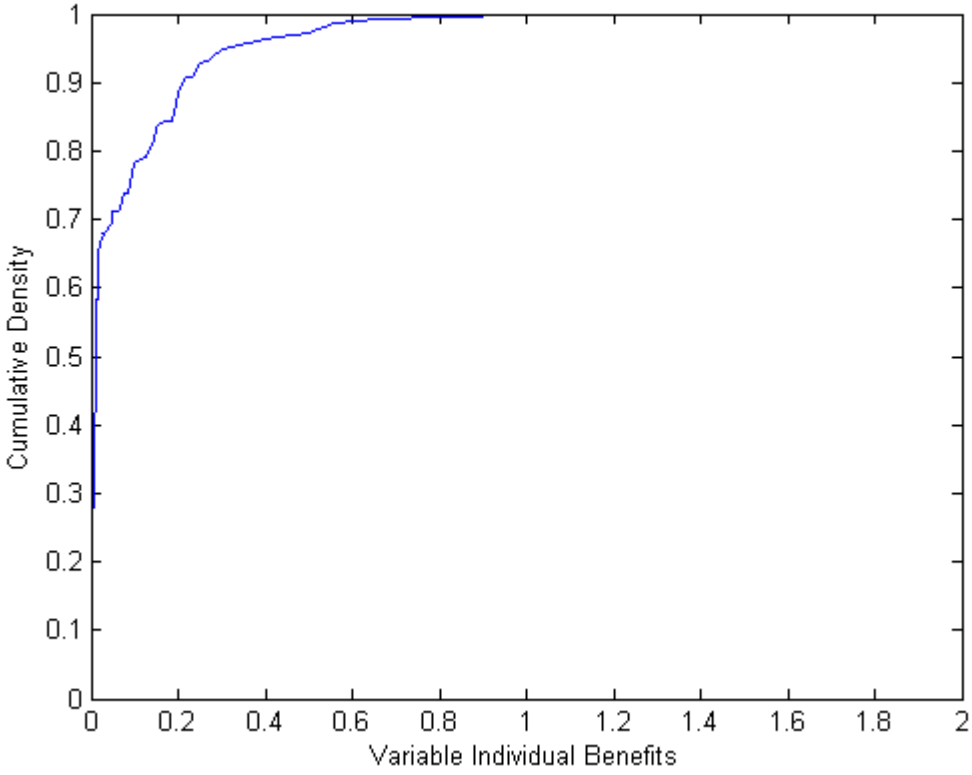
3.3. Surpluses estimation method and comparative statics

This study uses the empirical cumulative density function (ECDF) based on the net benefits of end users to estimate the demand functions for card usage and cashless payments acceptance. The non-parametric method of demand functions estimation is chosen because it allows the end-user heterogeneity to be captured in full, which is especially important in the light of the conflicting results in theoretical models and in the empirical ex-post analysis of regulatory efficiency. Any assumptions on the parametric distribution, although making the analysis computationally easier, would result in a worse fit of the actual data and, therefore, may produce misleading results (Delgado & Robinson, 2006; Tsay, 2016). In academic literature on payments, quasi-demand estimations are rarely used. Arango-Arango, Bouhdaoui, Bounie, Eschelbach & Hernandez (2018) uses it in the similar context of modeling the demand for cash withdrawals based on the payment diaries of the individuals.

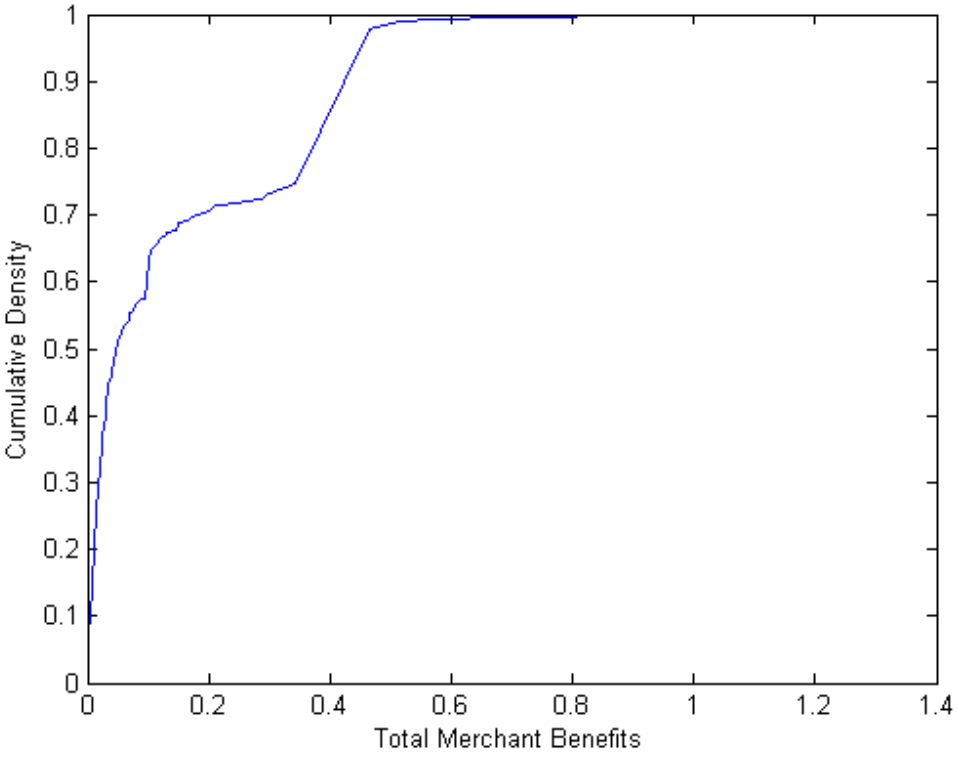
This study is complimentary in regard to the method from Arango-Arango et al. (2018) paper and it also uses the field survey data on the end-user behavior to estimate the demand for payment services. Besides, the ECDF estimations have been used for modeling the quasi-demand or willingness of some agents to participate in different market contexts such as the entertainment market (demand for DVDs) (e.g., Walls, 2010) and investments (e.g., Ye & Tiong, 2000).

The quasi-demand is estimated based on the net end-user benefits ($b_B - f$ & $b_S - m$). The method assigns the weights to the observed net benefits values such that the resulting density function is equivalent to the demand function $D_B \equiv Pr(b_B \geq f) = 1 - G(f) = 1 - J(b_B - f) = 1 - \frac{1}{n}\sum_{i=1}^{n} 1_{\{(b_B - f)_i \leq x\}}$ for cardholders and $D_S \equiv Pr(b_S \geq m) = 1 - K(m) = 1 - L(b_S - m) = 1 - \frac{1}{n}\sum_{i=1}^{n} 1_{\{(b_S - m)_i \leq x\}}$ for the merchants. Such an ECDF would converge to a parametric distribution and would produce similar results to assuming the density function in the case where benefits are drawn from some known distribution. However, in case the distributions of the benefits do not follow standard parametric distributions, these estimations would allow higher precision and more efficient estimators (Massart, 1990; Kontorovich & Weiss, 2014; Dvoretzky et al., 1956). The proximity of ECDF estimates to the distribution function form may be approximated based on the DKW inequalities.

Panel A: ECDF of variable individual benefits (quasi-demand of cardholders)



Panel B: ECDF of total merchant benefits (quasi-demand of cashless payments acceptance)



Panel C: ECDF of direct merchant benefits (direct benefits based quasi-demand of cashless payments acceptance)

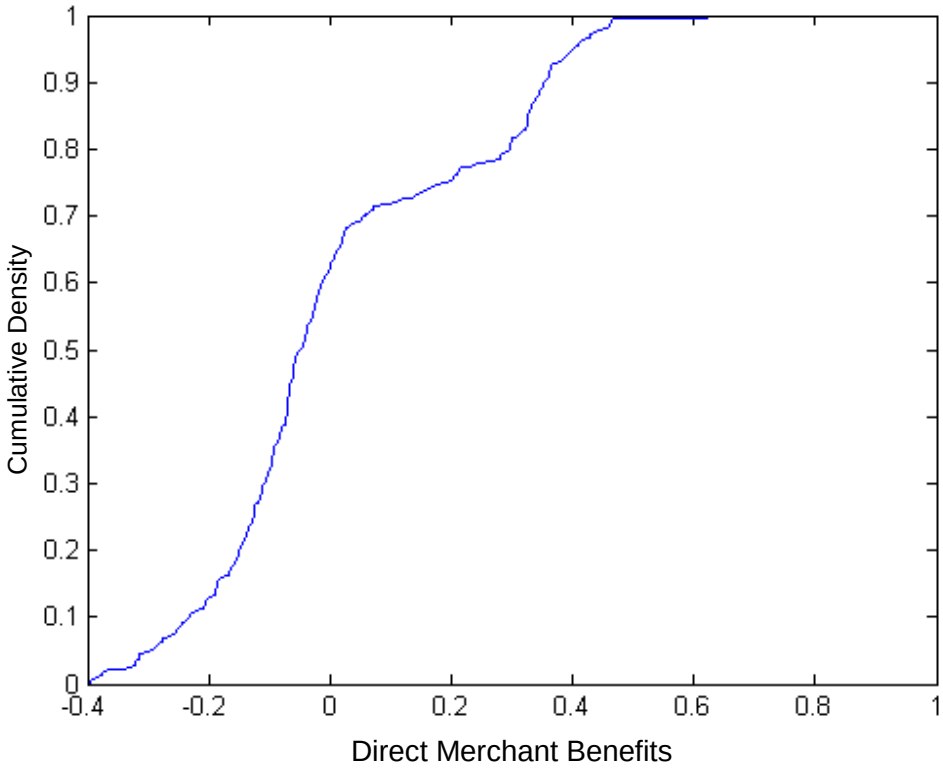


Fig. 1. Results of end-user demand estimations

Resulting estimates of the end-user quasi-demand are presented in Fig. 1. Panel A presents the ECDF of cardholders' variable benefits or, in other words, quasi-demand for paying with a card. The benefits are shown as a percentage of the transaction on the x-axis. Results are equivalent for the rubble denominated benefits. The cardholders' benefits do not seem to follow any known standard distribution. At average value of variable cardholders' benefits the quasi-demand for payments is at the elastic part. The elasticity of demand is even larger at the median value of benefits. This partially supports the hypothesis H5, however, composite analysis on both market sides is needed. At the average value of benefits the quasi-demand predicts perfectly the share of cardholders paying with the card (73.7% of cardholders in both the surveys and demand estimations). This result is also supported by other surveys of the current state of Russian retail payments market (e.g., NAFR, 2014; Central bank of Russia, 2014).

Panel B presents the results for the merchants' demand estimation. The denomination of benefits is similar to that of the cardholders' demand. As in the case of the cardholders' demand, the merchants' demand does not seem to follow standard known parametric distributions and is elastic at both average and median values of benefits. Elasticity of

merchants' demand seems smaller than that of the cardholders, however, this needs to be tested formally in further analysis. At the average value of benefits value the quasi-demand predicts a larger share of the accepting merchants (68.94%) than that found in surveys (51%). Although it should be mitigated at least partially in the method and it should not affect the curvature of demand; this result may be explained by the fact that the benefits values in Krivosheya & Korolev (2017) are available only for the accepting merchants, while the demand tries to capture the behavior of all merchants. This is not an issue for the cardholders' analysis as only those who have a card can decide whether to pay with it or not. Merchants unlike cardholders make only one decision to accept cards. However, at the median level of benefits, the merchants' demand predicts perfectly the average share of accepting merchants (51%). To eliminate the potential bias caused by the overestimation of the share of accepting merchants and to test the robustness of results this study uses median merchants' benefits with average cardholders' benefits in the supplementary analysis section. In the main analysis the average benefits are still used to predict the changes in buyers' and sellers' surpluses as the curvature of demand should be preserved. For the evaluation of the effect of changes the curvature (elasticity) is a more important criterion than the precise prediction of the accepting share.

To test the robustness of the results and analyze the effect of potential information asymmetry outlined in Krivosheya & Korolev (2017) this study also uses the direct benefits based ECDF in supplementary analysis. The opportunity benefits share of total benefits corresponds to the strategic (competitive) benefits of the card acceptance and may be known to merchants only. Merchants may use this asymmetry to promote tariffs cuts to the regulators (Krivosheya & Korolev, 2017). The results of the estimation are presented in panel C. Overall, no significant differences in merchants' demand are visible compared to the total benefits-based demand except for the value of direct benefits that may be negative.

Fixed cardholders' benefits and the share of cardholders are estimated directly using the surveys and the results in Krivosheya & Korolev (2016). The counterfactual experiment explained in Krivosheya & Korolev (2016, 2017) and performed in the finance, payments and e-commerce chair's retail payments study in 2014 shows that banks are unlikely to change the fixed fees, while cardholders are unlikely to refute cardholding as a result of loyalty programs and the quality of services changes. That is why this study assumes that the share of cardholders and the fixed benefits are unaffected by the MIF changes.

Efficient fees and end user surpluses under both efficient and current MIF rates are calculated based on the adopted version of the theoretical model by Bedre-Defolie & Calvano

(2013) presented in previous section. Unless noted otherwise, the total benefits function is used as it incorporates the strategic nature of card acceptance simultaneously with merchants' heterogeneity and platform competition (unlike in theoretical models).

This study also uses the comparative statics analysis in order to assess the effect of changes in MIF rates on end-user surpluses. In most of the analysis, unless noted otherwise, the assumption of the perfect pass-through by issuers and acquirers is kept. Even in the case where the pass-through is not perfect, the internalization of some part of the MIF changes would change the total surplus of the market as the profits of the banks would change. Although the effect on end users will not be equivalent to the theoretically predicted one in this case, the analysis with perfect pass-through still provides a useful benchmark for the ex-ante analysis of the regulatory initiatives. Under imperfect pass-through, assuming the smaller pass-through of favorable changes compared to the adverse changes, the effect on the end-user surplus will be more detrimental. The contrary is true for the smaller pass-through of adverse changes compared to favorable ones. Pass-through assumptions are relaxed in later sections of the analysis. Also, comparative statics is an as-is analysis and, hence, ignores any changes in the gross benefits values resulting from the changing market structures, changes in product mixes or changes in financial literacy levels.

4. Results

4.1 Current MIF rates and preliminary efficiency assessment

In order to assess the efficiency of current MIF rates we compare the existing MIF rates with those that should have been theoretically imposed by the payment system (association) in equilibrium according to the Bedre-Defolie & Calvano (2013). To do so, we calculate the surpluses and transaction volumes and compare them to the surpluses implied by the MIF rates from theoretical model. This approach allows testing the semi-strong form efficiency of MIF rates and serves the basis for further analysis of the strong-form efficiency. Table 2 presents the results.

Line 3 of panel A in table 2 shows that the buyers' surplus calculated at the mean level of benefits of individuals and merchants is 6.65% of transaction value, sellers' surplus is 6.15% and the transaction volume is 37.61%. The market is almost evenly balanced in terms of the aggregate surpluses of buyers and sellers with some imbalances towards the buyers.

This fact might be explained by the emerging nature of the Russian retail payments market. Due to the stimulating role of MIF rates, payment systems might increase MIF rates above the cost rebalancing levels to stimulate the payments activity (Humphrey, 2010; Jonker et al., 2017; Rochet & Tirole, 2006, 2011; Rochet & Wright, 2010; Verdier, 2011). This effectively increases the transaction volume because individuals, unlike merchants, make two decisions in the market: the decision to participate in the market and the decision to use cashless instruments once they are participating (Bedre-Defolie & Calvano, 2013; Krivosheya & Korolev, 2016, 2017; Rochet & Tirole, 2011). Higher MIF rates might result in more stimulating programs and better conditions from the issuing banks, which might drive the payment activity (Bedre-Defolie & Calvano, 2013; Krivosheya & Korolev, 2016, 2017; Rochet & Tirole, 2011).

Tab. 2. MIF efficiency assessment

	Panel A: Estimation at average benefits values					
	Individuals Benefits	Merchant Benefits	Buyers' surplus (BS)	Sellers' Surplus (SS)	Total Surplus	Volume of transactions
Lower efficiency bound	0%	15.55%	3.75%	0.26%	4.01%	1.67%
Upper efficiency bound	7.70%	15.55%	6.65%	5.85%	12.50%	37.61%
Currently set MIF rates	**7.70%**	**16.34%**	**6.65%**	**6.15%**	**12.80%**	**37.61%**
	Panel B: Estimation at median benefits values					
Lower efficiency bound	0%	4.21%	3.75%	0.05%	3.80%	1.13%
Upper efficiency bound	1.09%	4.21%	3.95%	0.75%	4.70%	17.87%
Currently set MIF rates	**1.09%**	**5.00%**	**3.97%**	**0.98%**	**4.94%**	**19.51%**

Notes: The table presents the results of the MIF efficiency assessment. Panel A presents the estimation at average benefits values, and panel B, at the median end-user benefits values. Lower bound is obtained using the break-even fees set by acquirers and issuers as described in the baseline model of Bedre-Defolie & Calvano (2013). Upper bounds are calculated using the same model assuming that the currently set variable cardholders fees are efficient. Current fees are calculated using the fit of the surpluses at average and median benefits values.

As seen in panel B of Tab. 2, for a median level of individuals' and merchants' benefits these values decrease to 3.97% for the buyers' surplus, 0.98% for the sellers' surplus and 19.51% for the transaction volume. Although the surpluses calculated at average benefits might better reflect the situation for the market as a whole, the analysis at the median benefits provides insights into the welfare of the most common end-user groups. As shown in Krivosheya & Korolev (2016, 2017) and in Fig. 1 the benefits distributions are largely skewed to the right with most of the observations clustered near zero values; hence the analysis at median values, which are closer to zero than the average values, may offer more insights into the effect of changes and MIF efficiency for most common groups in the sample.

Merchants' surpluses decrease by larger amount because of the presence of fixed individuals' benefits that are independent of the transaction volume. With the fixed benefits subtracted, the buyers' surplus becomes 0.21%, which is 4.67 times lower than the surplus of the merchants. This result is largely driven by the decreased demand for payment services despite almost unchanged demand for cardholding. The value of the card paying option does not contribute to a considerable share of fixed benefits. This result is supported by the surveys: only 2% of the individuals that participate in loyalty programs (or 0.45% of all the surveyed cardholders) plan to stop using payment cards completely (even a smaller share of cardholders will terminate the payment card contract) in cases where the loyalty programs are abandoned. Because of the smaller value of surpluses more vulnerable to changes in MIF rates are median cardholders and merchants. .

In order to calculate the theoretically motivated cost-balancing fees we use the calculated long-term average costs of the acquiring (issuing) banks and add (subtract) the MIF rates to calculate the equilibrium merchant discount fees $m^* = c_A + a$ ($f^* = c_I - a$). For the costs related to the credit cards in issuing banks we also subtract interest payments which are used to finance some of the costs attributable to the credit line and loan financing. The long-run average costs are the weighted average of the individual banks average costs, where weights are calculated as a share of the bank in total transaction volume in the sample. The long-run average costs include fraud-management costs, authorization, processing and other payment system's tariffs related costs, interstate clearing, payments-related risk management, operational costs, client attraction and attrition costs, etc.

Both issuing and acquiring banks are expected to impose positive variable (per transaction) cardholders' fees. However, in case of the cardholders such costs are not empirically relevant as banks do not charge cardholders per payments or even reward them using loyalty programs. Based on the cost study performed by the finance, payments and e-

commerce chair in 2014, the fixed cardholders' fees and regular fees (such as the fees for SMS informing, mobile banking, etc.) were found to be insufficient to cover the average per transaction costs. Therefore, issuing banks internalize at least some part of the costs associated with the cashless payments, which later become losses for issuing banks or can be financed by other revenues resulting from the payments business (such as the revenues from using money from cardholders' balances or cross-sales). This result is supported by both the cost study and in-depth interviews. Experts and bankers note that the issuing banks try to earn money by either cross-selling or using money from cardholders' balances, or else internalize the costs. Yet, most of the experts and bankers, as well as the cost study, show that issuing banks have small or even non-existing profit margins.

To assess the efficiency of current MIF rates we, therefore, introduce the efficiency bounds. As a lower bound, we assume that in the theoretically implied equilibrium derived by Bedre-Defolie & Calvano (2013) the banks would set the fees to fully offset the costs or at least offset the costs remaining after the fixed and regular fees revenues. In this case cardholders' variable fees become positive, thereby decreasing the average net benefits and payments demand. As an upper bound, we assume that the issuers fully internalize the costs of the payments business and set the same fees (finance same loyalty programs and offer same level of services as in empirical case).

As seen in Tab. 2, theoretically implied surpluses at both the average (panel A) and the median (panel B) values are smaller than the currently imposed fees. For the lower bound this happens because of the destroyed buyers' incentives to use payment cards. Where fees are not internalized by issuers, the quality of services drops, while the loyalty programs are terminated. Even where fees are not actually imposed by issuers, the decline in the quality of services (e.g., increased processing time, larger fraud risks, etc.) drives individuals into cash usage. Also, the lack of internalization of fees by merchants decreases acceptance rates, which lowers the surpluses on both end-user sides. Hence, currently imposed fees offer a Pareto improvement compared to the theoretical fees derived by Bedre-Defolie & Calvano (2013), which supports hypothesis H1. We, therefore, use current fees as a benchmark for the remaining analysis.

Strong efficiency of current fees is guaranteed by several factors. Firstly, banks internalize some costs trying to finance them via alternative means (such as cross-sales or using cardholders' money in banking). Secondly, payment systems impose MIF rates that stimulate the issuing side of the business. Combined with high elasticity of cardholders' demand this drives up the transaction volume and surplus on both market sides due to

network effects (Bounie, François, & Hove, 2016; Carbó-Valverde, Liñares-Zegarra, & Rodríguez-Fernández, 2012; Chakravorti & Roson, 2006; Jonkers, 2011). Although the discrepancy in costs after the MIF rate payment (as reported by cost study) is not statistically or economically significant (the difference is smaller than 1-5%), additional cost savings at the issuers' side help internalize costs more efficiently and provide the level of services necessary to stimulate the cardholders' demand. Finally, the elasticity of merchants' demand at the mean and median values is lower than the elasticity of cardholders, which means that the stimulation of cardholders' demand will bring more surpluses to both sides of the market.

4.2. The effect of changes on welfare

In order to assess the strong-form efficiency of the MIF rates and provide a comprehensive analysis of current MIF rates efficiency we show the effect of changes in MIF rates on the end-user welfare. We consider two exogenous sources of changes in MIF rates: based on the surveys and based on the potential regulation for the Russian retail payments market. The results of the former are shown in this section, while the latter is highlighted in the subsequent section of this paper. This analysis is presented to check the validity of the developed empirical mechanism. In order to test the validity, we compare the effects of changes in MIF rates that are predicted by the developed mechanism to the results of the counterfactual experiment. In particular, we calculate the buyers' and sellers' surpluses under the assumption of a perfect pass-through of costs to the end users and compare the changes in surpluses to the highlights from the surveys. Even if the pass-through is imperfect, the change in MIF rates will result in the change of the banks' costs and will lower the profitability of payments business. The amount to be internalized is equal to the change in the MIF rates less the change in the end-user fees, multiplied by the transaction value at a particular bank. The results of the in-depth interviews suggest that even the smallest adverse changes in MIF rates will be internalized by neither the issuers nor the acquirers due to the near zero profitability margins. We therefore assume that the changes in MIF rates are perfectly passed through to the end users. This assumption is relaxed at the end of this section and in the supplementary analysis.

Before looking into changes in MIF by arbitrary amounts to analyze the possibility of Pareto and social welfare improvements, we examine the effect of a 50 percent cut and a two fold increase in current MIF rates. These changes were the basis for a counterfactual

experiment in the 2014 finance, payments and e-commerce chair's retail payments study.. By combining the results of the counterfactual experiment from surveys and the formalized changes in surpluses we will be able to get insights into the precision of comparative statics analysis. The results also vary for the subsample of banks without a large share of on-us operations. The on-us MIF rates are usually smaller and on-us operations result in the redistribution of costs within the bank. Isolating the subsample of banks with few on-us operations we can assess the effect of changes on the interbank operations and show the potential effects of changes on the competitive landscape of the payments business in Russian banks. Tab. 3 presents the results. Panels A and B show the effect of changes for the whole sample at the average and median values of benefits, respectively, while panels C and D represent the results for banks with a small share of on-us operations.

Tab. 3 goes here.

In the case of a twofold MIF decrease (by 50%), the merchants receive smaller fees, while the services or fees for the cardholders become less favorable. Analysis of the whole sample at averages (panel A) shows that even though the demand for card acceptance increases by 1.1% (or 0.76 percentage points) the demand for payments services by individuals drops by 2.96% (2.18 percentage points) resulting in the surpluses decrease for both end-user sides. The transaction volume drops as well. However, the decrease in the surpluses is larger than the change in the payments services demand. Surpluses of the cardholders and the merchants change by 5.79% and 4.14%, respectively. The gap between the surpluses becomes smaller and the acquiring side of the market is stimulated more in this case. Overall, the decrease in MIF rates by 50% is neither Pareto nor social welfare improvement.

The effect of changes is more severe for the median end users. Halving the MIF rates and the respective change in the quality of offered services leads to a more than twofold decrease in the demand for cashless payments by median cardholders (-65.28% change), while only a 4% increase in the merchants' demand. The transaction volume more than halved. However, since the cardholders are protected by the level of fixed benefits and due to the insensitivity of option value of being able to pay with card to the changes in MIF rates the decrease in the cardholders' surplus is less severe (-4.92%). Merchants, on the other hand, are affected by the decrease of transaction volume by a greater extend and their surplus drops proportionally (-43.48%). Overall, the median end user also experiences neither Pareto nor total welfare improvement. This result is largely driven by the high elasticity of cardholders'

demand to changes in MIF rates. The analysis at median benefits supports hypotheses H4 and H5.

The analysis of the subsample of the banks without a large share of on-us operations provides similar results with a larger amount of magnitude due to a larger change in the MIF rates in absolute terms. For the average merchants and individuals (panel C) the change in surpluses has the same sign as in previous analysis of the whole sample but of larger magnitude. As a result, the gap between the surpluses increases with more stimulation on the acquiring side of the payments business. For the median consumer the effect of changes is even more severe. Due to the magnitude of MIF rates changes, a complete pass-through of the changes in MIF rates on cardholders would result in the market destruction (no transactions at all). This supports hypothesis H3.

The banks with a small share of on-us operations and the clientele with median benefits are usually small regional banks. Besides, these banks are likely to be within the social banks group and are unlikely to have any significant share of premium services users. In such banks, the profitability margins are smaller than the sample's averages. a 50 per cent cut in MIF rates is likely to result in the closure of such banks as the changes in the cost structure due to changes in MIF rates are unlikely to be internalized. This would lead to the monopolization of the retail payments market and, as a result, may affect the quality of services offered as well as the terms of such offerings. Overall, a 50 percent decrease does not produce any efficiency gains.

At the transaction volume for the year of the surveys and the year of the benefits calculation, halving the MIF rates would result in an approximate 45.24 billion rubles cost increase for all banks. For the subsample of banks without a large share of the on-us transactions (usually smaller banks) this figure is even larger. Halving the MIF rates for them translates into an increase in costs of approximately 107.43 billion rubles. According to the survey data, 30% of the cardholders who pay with cards participate in loyalty programs. In absolute terms this accounts for approximately 23.89 million people. Assuming the perfect pass-through and the fact that the banks will suspend the loyalty programs as an initial reaction, this accounts for 1893.67 rubles less on loyalty programs, which is larger than the current cost of loyalty programs per one card even for the group of banks with a larger share of premium customers. Considering that some banks do not offer any loyalty programs to their customers, some customer groups and banks may also be affected through other mechanisms (e.g., quality of services, fixed fees, the cost of additional services, etc.). The figure is larger for the subsample of banks with a small share of on-us transactions.

Even a 0.1 percentage points decrease in MIF rates is equivalent to an approximate 5.18 billion rubles increase in the costs. This is similarly true for costs decrease for acquirers. Thus the changes in MIF rates might result in a massive suspension of loyalty programs and affect the quality of services as well. Such an analysis may be performed for any change in MIF rates described below, however, we focus on the relative (percentage) notations prescribed by the theoretical model since the conversion of the effect of changes in monetary terms requires additional restrictive assumptions (e.g., banks homogeneity).

The results of the counterfactual experiment support additional highlights suggested by the analysis of the effect of changes in monetary terms. Halved MIF rates would result in the suspension of all loyalty and co-brand programs. Many banks note that such a reaction is likely even for smaller decreases in MIF rates. Some banks consider raising or introducing cardholder fees as well. Acquirers, however, will pass through the decrease to merchants. Experts also note that the changes are likely to result in the monopolization of the market and the exit of smaller banks. A 1.5 times lower merchant discount fee would lead to an increase in the retail volume at 25% of merchants and decrease in costs for 64% of merchants, however, only 25% of merchants consider changing the prices.

At the same time, whilst suspension of loyalty programs will not affect the share of cardholders, it is likely to result in the decrease of card usage by 20% of the loyalty program participants. Loyalty program participants pay with a card 15-20% more often compared to other groups and thus stimulate the transaction volumes. The increase in fees would result in a general decrease in the demand for cashless payments. Doubling the fees would result in 20% of cardholders refraining from using cards. Salary cardholders and low-income groups are even more vulnerable to changes and are likely to refrain from using cards should any fees be introduced. Overall, the decrease in the MIF rates by 50% is likely to produce at most a 3% increase in the acceptance volumes, however, these figures do not account for the payment activity decrease and the effects of indirect network externalities.

Overall, the counterfactual experiment supports the results of the comparative statics analysis, however, giving some new insights into possible overreaction by the issuers and the sources of more detrimental effects on the welfare of end users. The outcome of such regulation is likely to be consistent with the literature and may result in a total welfare decrease as in the case of the developed markets regulation (Weiner & Wright, 2005; Krivosheya et al., 2015).

Symmetric analysis of the twofold increase in MIF rates, although empirically not as relevant as a 50 percent cut in the MIF rate, is also shown in Table 3. A 100% increase in

MIF rates results in more funds (lower costs) for the issuing banks and more costs for the acquirers. Such increase also drives the gap between the surpluses of the cardholders and merchants since the current situation already stimulates the issuing side of the market rather than preserves the pure balance of the buyers' and sellers' surpluses, which is true for all of the analysis cases (at median and mean values of benefits as well as for the subsample of banks with a low share of on-us operations). In all of the cases the buyers' surplus increases at the expense of the sellers' surplus, and the magnitude of the increased demand for cashless payment instruments is not enough to offset the adverse effect on the merchants' benefits and the demand decrease. None of the situations offer efficiency gains compared to the status quo.

Interestingly, for the whole sample analysis the transaction volume decreases in the case of the average benefits but increases for the analysis at the median level of benefits. This is due to the changing elasticity of the cardholders' demand to the changes in benefits size alongside the quasi-demand curve. At the mean level of benefits, the cardholders' demand is closer to the less elastic part, while at the median level the elasticity of demand is larger. This is similarly true for the merchants' demand. In the case of the subsample of banks with a low share of on-us operations, the converse is true. The elasticity of cardholders' demand at the mean level of benefits is larger than the elasticity of merchants' demand. Increased usage of cashless payments results in additional transaction volume even despite fewer places where cashless payments are accepted.

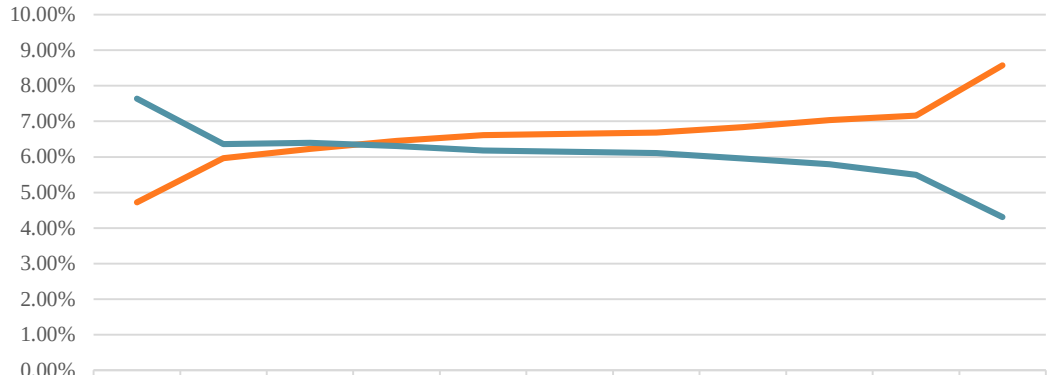
These results correspond as well to the highlights of the counterfactual analysis. The increase in MIF rates by 100% will result in a heavier funding of stimulating programs and cashless products promotion by issuers, who are likely to pass through up to 60% of the increase to the cardholders. Acquirers, however, will pass through the increase completely, which would lead to asymmetric changes in the market and a more severe decrease in the total welfare as well as separate end-user groups' surpluses. An increase in the merchant discount fees of 50% (non-complete pass-through) would result in an increase in retail prices at 57% of merchants and increase in costs at 75% of merchants, which is likely to affect the retail market structure as well. In the case of a twofold merchant discount fees increase, a considerable share of merchants would also refrain from accepting cashless methods. A twofold increase in the loyalty programs would result in 46% of individuals [using cards for payment more often. Also, a decrease in cardholders' fees may attract additional cardholders' groups (4% of respondents that do not have a card are not satisfied with the current terms, while 49% of such respondents may be attracted by heavier card promotions). Overall, a

twofold increase in MIF rates is likely to increase the profitability of the issuers, however it is also likely to affect adversely the retail prices and the welfare of the individuals.

The results of the analysis presented above support the validity of the proposed empirical mechanism for the MIF efficiency evaluation. Neither a 50% decrease nor a 100% increase in the MIF rates produces a result that contradicts the highlights from the counterfactual experiment. However, the results provide more in-depth insights, previously not made available, and account for the economic principles of the market formation, especially for the end user in the different parts of the market.

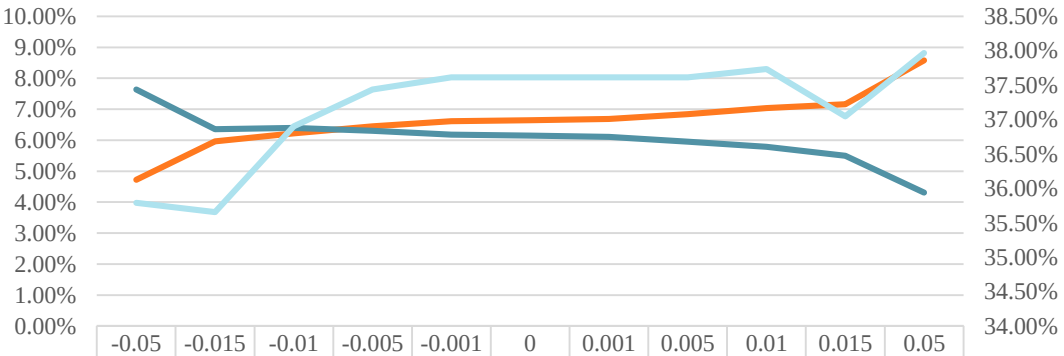
In order to highlight further the effect of changes in MIF rates for the welfare of the end users and to test the strong-form efficiency of the rates currently set we have considered arbitrary changes of up to 0.05 percentage points. Panels A-C in Fig. 2 present the results of the comparative statics analysis for the surpluses at means. The results of the comparative statics analysis at median values of benefits are presented in panels D-F. The analyses of the whole sample and of the subsample of banks with a low share of on-us transactions coincide because the changes in MIF rates are by arbitrary amounts. Buyers' and sellers' surpluses calculated at average benefit values balance with a MIF decrease by approximately 0.69 percentage points. An increase in MIF rates drives the surpluses further away, increasing the buyers' surplus and decreasing the sellers' surplus. The decrease in MIF rates below 0.69 percentage points decreases the gap between the end-user surpluses, while further MIF cuts lead to the sellers' gain at the expense of the merchants. None of the changes are Pareto improvements compared to the status quo. To assess the effect of changes in MIF rates on the social welfare we have analyzed the average between BS and SS values (panel C). Total welfare decreases because of MIF rate cuts due to the decrease in the transaction volume resulting from the high elasticity of cardholders' demand for cashless payments. An increase in MIF rates by up to 1 percentage point leads to both transaction volume and total surplus increase. For more extreme changes (e.g., 5 percentage points increase) the total surplus increases by an even larger amount. Overall, the increase in MIF rates under the assumption of the perfect pass-through, although not empirically relevant, may produce social welfare but not a Pareto improvement.

Panel A: Buyers' and sellers' surpluses



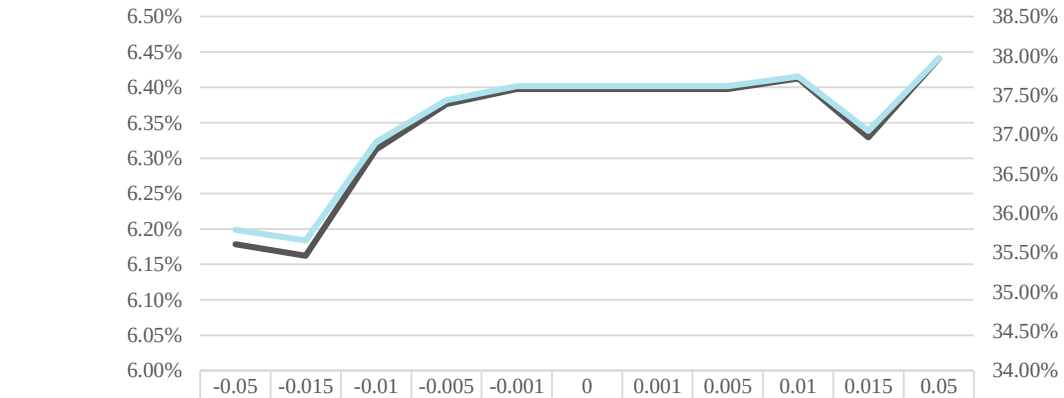
	-0.05	-0.015	-0.01	-0.005	-0.001	0	0.001	0.005	0.01	0.015	0.05
BS	4.72%	5.96%	6.23%	6.45%	6.61%	6.65%	6.69%	6.84%	7.04%	7.16%	8.58%
SS	7.64%	6.36%	6.40%	6.30%	6.18%	6.15%	6.11%	5.96%	5.79%	5.50%	4.31%

Panel B: Transaction volumes and end-user surpluses

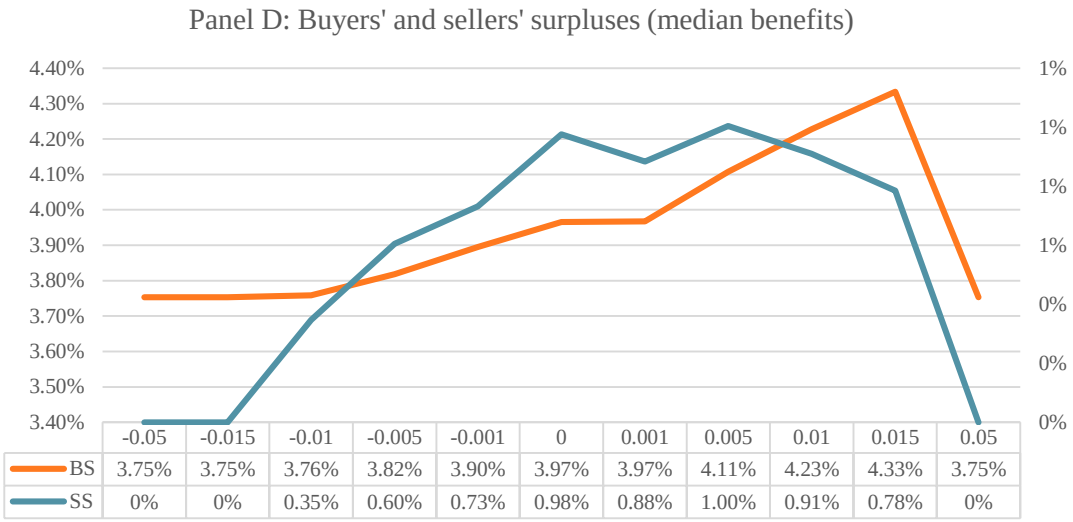


	-0.05	-0.015	-0.01	-0.005	-0.001	0	0.001	0.005	0.01	0.015	0.05
BS	4.72%	5.96%	6.23%	6.45%	6.61%	6.65%	6.69%	6.84%	7.04%	7.16%	8.58%
SS	7.64%	6.36%	6.40%	6.30%	6.18%	6.15%	6.11%	5.96%	5.79%	5.50%	4.31%
V	35.79%	35.65%	36.90%	37.44%	37.61%	37.61%	37.61%	37.61%	37.74%	37.05%	37.97%

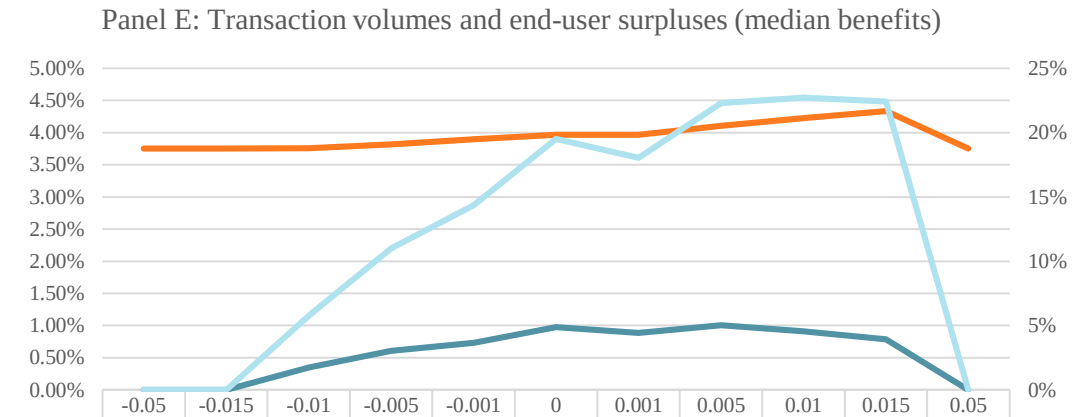
Panel C: Average surpluses and the transaction volume



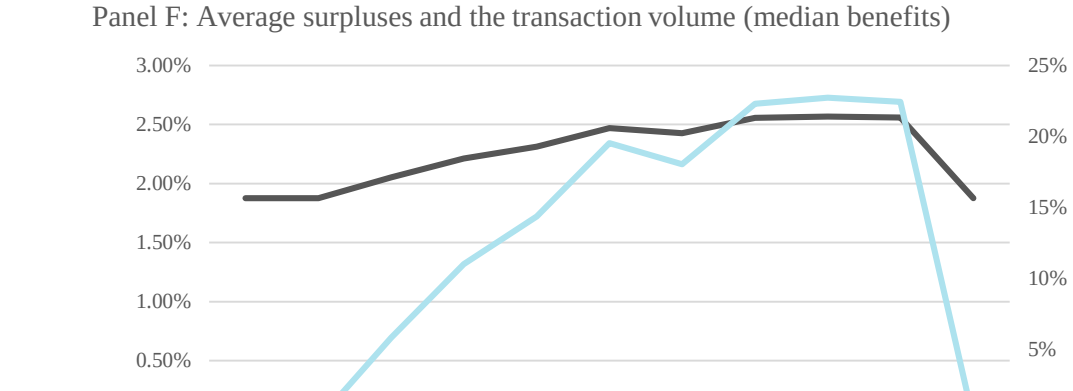
	-0.05	-0.015	-0.01	-0.005	-0.001	0	0.001	0.005	0.01	0.015	0.05
Average BS SS	6.18%	6.16%	6.31%	6.38%	6.40%	6.40%	6.40%	6.40%	6.41%	6.33%	6.44%
V	35.79%	35.65%	36.90%	37.44%	37.61%	37.61%	37.61%	37.61%	37.74%	37.05%	37.97%



	-0.05	-0.015	-0.01	-0.005	-0.001	0	0.001	0.005	0.01	0.015	0.05
BS	3.75%	3.75%	3.76%	3.82%	3.90%	3.97%	3.97%	4.11%	4.23%	4.33%	3.75%
SS	0%	0%	0.35%	0.60%	0.73%	0.98%	0.88%	1.00%	0.91%	0.78%	0%



	-0.05	-0.015	-0.01	-0.005	-0.001	0	0.001	0.005	0.01	0.015	0.05
BS	3.75%	3.75%	3.76%	3.82%	3.90%	3.97%	3.97%	4.11%	4.23%	4.33%	3.75%
SS	0%	0%	0.35%	0.60%	0.73%	0.98%	0.88%	1.00%	0.91%	0.78%	0%
V	0%	0%	5.78%	10.99%	14.35%	19.51%	18.04%	22.31%	22.73%	22.43%	0%



	-0.05	-0.015	-0.01	-0.005	-0.001	0	0.001	0.005	0.01	0.015	0.05
Average BS SS	1.88%	1.88%	2.05%	2.21%	2.31%	2.47%	2.43%	2.56%	2.57%	2.56%	1.88%
V	0%	0%	5.78%	10.99%	14.35%	19.51%	18.04%	22.31%	22.73%	22.43%	0%

Fig. 2. The results of a comparative statics analysis of MIF changes on the end-user surpluses and transaction volumes

The situation is similar for the comparative statics analysis at median values of benefits except for the fact that the more severe changes in MIF rates result in the abandonment of any cashless transactions by merchants in the case of a sufficient increase in MIF rates and by cardholders in the case of a decrease in MIF rates. Again, the cutoff (prohibitive) change of MIF rate is smaller for cardholders (in terms of the absolute value of changes) than for the merchants, which supports the higher elasticity of cardholders' demand. The surplus of merchants calculated at the median level of benefits is smaller than the surplus of cardholders for any level of MIF changes. This happens because of the fixed cardholders' benefits attributable to the fact of having a payment card and money balances at a bank account that guarantee a positive cardholders' surplus even with null transaction volume. Unlike the case of analysis at mean levels of benefits, there are both Pareto and total surplus efficiency gains compared to the status quo.

As shown in panel E of Fig. 2, an increase of MIF rate by 0.5 percentage points results in the surplus gains for both end users as well as an increase in the transaction volume, which is explained by the differences in quasi-demand elasticities of consumers and merchants. Further increases in MIF rates increase the buyers' surplus at the expense of sellers. The decreases in MIF rates decrease the surpluses at both sides of the market as well as drive the transaction volume down. Total surplus increases with the increase in MIF of up to 1 percentage point. Overall, for the median consumers a small increase rather than the decrease of MIF rates is desirable. However, such an increase would distort the average consumer and therefore is not the first best policy. The median end users cannot be approached in the same fashion as the average consumers. In fact, a decrease in the MIF rates desired by merchants would result in either a decrease in the transactions volume (or a complete disappearance of transactions for the median consumers); or issuing market monopolization as the small profitability margin of usually social oriented banks will prohibit internalization of a cost increase. An optimal regulation would, therefore, produce different effects for different parts of the market: the effect of changes should be smaller or going in the other direction for the median end users (or the users with smaller benefits value and, hence, demand for cashless payments).

Such an imbalanced effect is impossible with the change of the MIF rates, which without other policies (such as banks subsidizing, reimbursement of the groups with surplus decreases by national loyalty programs and other national or local initiatives aimed at reimbursement of losses), or even with them (if implemented ineffectively), would not be able to produce any market-wide efficiency gains. Moreover, banks can react differently than

prescribed by theory. First, there may be an overreaction due to irrationality. Secondly, even under the assumption of rationality, the issuing banks operate internalizing losses covered by alternative means of revenue generation. MIF changes will result in a change in payment business-related costs, which might be optimally covered by the change in cardholders' fees or offerings. The managerial decisions regarding the payments business and, specifically, the payments products pricing and payments operations are usually separated from other managerial decisions and strategic considerations. At the same time, payments business does not constitute a stand-alone P&L line; it is accounted for in the general P&L that is analyzed and managed at a higher level of management. Hence, even though there might be enough money to cover potential changes in costs due to changing MIF rates, the manager responsible for the payments business might rationally decide to change the pricing or the offering due to the lack of information or its asymmetry between the departments within the bank (especially if the bank is large and operates across different regions).

The total cost of the initiatives mitigating the effects of MIF changes for some groups (including the analysis of the affected parties, creation of mechanisms and the implementation of the reimbursement) is likely to be higher than the costs of applying alternative stimulating measures directly to some parties (e.g., educational programs for low-income groups of individuals, reimbursement programs for smaller merchants). Besides, the reimbursement of banks needed because of the nature of MIF changes, coupled with imperfect pass-through, might lower the end-user welfare. That is why the optimal regulation or market stimulation should aim to isolate the effects of the changes/shocks to the intended groups (Krivosheya et al., 2015). MIF rates are market-wide mechanisms by their structure and therefore effective only when there are large imbalances between the end-user sides as was shown in proposition 1.

Overall, there is no Pareto improvement that would satisfy all parts of the market and produce a welfare gain. Current MIF rates are considered strong-form efficient. An increase in MIF rates by 1 percentage point might stimulate the total welfare due to increased payments demand by cardholders driving the transactions volume up even despite the decrease in acceptance rate by merchants. However, such a policy might result in the monopolization of the acquiring market and produce further market inefficiencies due to lower competition. Current fees are considered efficient, and no efficiency gains are available compared to the status quo. Hypotheses H1-5 of this study are supported.

4.3. Regulatory initiatives assessment

This section looks into the second source of exogenous changes in MIF rates: regulatory initiatives for the Russian retail payments market. The results are presented in Table 3. We begin with an analysis of the optimal regulation derived by Bedre-Defolie & Calvano (2013). Under the assumption of perfect pass-through, the average total benefits of merchants and variable benefits of individuals are equal if the MIF rate increases by 4.32 percentage points (141.34% compared to current rates). As before, the cardholders' surplus increases at the expense of merchants' surplus. For the analysis at the average level of benefits this constitutes a total welfare improvement compared to the status quo (the sum of surpluses increases by 1.43%). However, there is no Pareto improvement as the welfare of merchants decreases by 24.95%. The effect of changes is not symmetric across different end-user groups and is even more severe for the analysis at the median value of benefits. The transaction volume in this case drops by 65.28%, which decreases the merchants' surplus by 95.27% making it almost zero (0.046%). Total welfare drops by 15.7% as well. Overall, although the change in surpluses at average benefits values results in total welfare improvement, this result is not symmetric across the whole market and therefore cannot be considered as an efficiency gain. Moreover, the proposed regulatory intervention is certainly not Pareto efficient.

We have reassessed the results equating the total benefits of the individuals with the total merchants' benefits. Although the fixed benefits tend to zero with a large number of transactions and the results of surplus estimates should converge with the results presented above (when variable benefits equal total merchant benefits) we assume one transaction per month as an upper bound estimate for the total individuals' benefits. In this case the MIF rate should rise by 2.44 percentage points, which is lower than before. Yet, there is no Pareto improvement for either the median or mean benefits analysis. Total welfare improves for the average cardholders and merchants as well as for the median ones. Interestingly, for the analysis at median levels of benefits the total surplus reaches the maximum in this case. At average values of benefits, the total surplus is smaller than for the equality of variable cardholders' and total merchants' benefits outlined above. Overall, there is a total welfare efficiency gain without Pareto improvement; however, since this analysis presents the largest possible total benefits for the individuals it might be not empirically relevant and the improvement might not be present in practice, as outlined in the analysis above.

Regulators might use the direct benefits as an input for the regulatory decisions because of the potential information asymmetry between merchants and the rest of the market (Krivosheya & Korolev, 2017). This issue is analyzed in details in the supplementary analysis; however, to assess the effects of such interventions we have equated the variable individuals' benefits to the direct merchants' benefits. The benefits equality is obtained when MIF drops by 3.07 percentage points. This would reverse the MIF role and would reimburse acquirers at the expense of merchants, which is not empirically relevant; however, we have still analyzed the effects of this hypothetical change to consider the potential effect on the welfare of end users. The analysis is performed using the total benefits ECDF function as well as the direct benefits-based quasi-demand estimates.

Both total surplus and the surplus of the individuals decrease because of changes resulting from the lower transactions volume. For the median level of benefits, the transaction volume drops to zero, meaning that the market terms become prohibitive for the most vulnerable (low-benefit) groups. The gain in merchants' benefits at the median level of benefits is destroyed as a result.

To use the direct benefits function, we have reassessed the benchmark analysis (current market situation). At an average value of benefits, the analysis is equivalent to that of the quasi-demand based on total merchants' benefits. The median direct merchant benefits are negative (−4.65% of transaction's value), which is explained by the fact that merchants accept cards due to strategic reasons (accounted for in the opportunity benefits) and not just for the direct benefits of using cashless payments (such as increased security, speed of transactions, lower risks of fraud from cashiers, etc.). This leads to a negative sellers' surplus at this part of the market, which reverses the problem and makes merchants seek loss minimization rather than welfare maximization. An increase in MIF rates by 3.07 percentage points necessary for the equality of average direct merchants' benefits and variable individual benefits leads to a larger increase in the acceptance demand by merchants than in the case when total benefits-based quasi-demand was used. It happens because of the larger elasticity of the direct benefits-based quasi-demand function. Such analysis implicitly assumes that the change in the fees affects only a net direct portion of the merchants' benefits and does not relate to the opportunity benefits. This assumption might lead to the overestimation of the merchants' reaction, as the average end-user total welfare and transaction volume are almost unaffected (drop by less than 1% each). However, the welfare redistributes from individuals to merchants without Pareto improvement.

For the median part of the market the transactions stop, which produces total welfare and merchants' surplus improvement because of the negative values of surplus in the status quo. Cardholders' surplus drops to the value of fixed benefits and constitute at most (under the assumption of unchanged fixed benefits and 1 transaction per month) 3.75% of transactions. There is no Pareto efficiency gain, while total surplus increases for the median part of the market. Although the regulators might use these results and demand functions because of the information asymmetry, these results might not reflect the true effect of changes due to the number of strict assumptions made above.

Finally, we have analyzed the effects of the best-practice regulation for the Russian market. One of the most recent regulatory interventions in the payments market happened in the EU (Ardizzi, 2013; Malaguti & Guerrieri, 2014; Snellman et al., 2001). Although the effects of the intervention are not yet fully understood and there are conflicting views on the efficiency of regulation (Carbo-Valverde & Liñares-Zegarra, 2012; Jonker et al., 2017; Malaguti & Guerrieri, 2014) it is worth considering as the regulators across the world might adopt the policies at local markets. European regulation tried to equate MIF rates to the cost of cash estimates, which is preliminary evaluated at 0.2-0.3% (Malaguti & Guerrieri, 2014). There are no cost of cash estimates for Russia yet, so we use the same benchmark for the hypothetical change in MIF.

For all parts of the market such change does not produce a Pareto or total welfare improvement. The most vulnerable groups cannot withstand the changes in market terms and leave the market. The transaction volume at the median levels of benefits drops to zero and so does the surplus of merchants. For the subsample of banks without a large amount of on-us transactions the decrease of MIF rates to the 0.2-0.3% level requires a larger decrease. This leads to a reduction of the transaction volume and buyers' surplus by a larger amount. At the median level of benefits, the transaction volume and the merchants' surplus drop to zero as in case of the whole sample analysis. The internalization of costs would also require giving up a considerable portion of the profit margin (up to 1.5 percentage points for all banks and up to 4.2 percentage points of transaction volume for banks without a considerable on-us portion of operations that would destroy the profitability of payments business for most of the banks). Changing MIF to 0.2-0.3% is neither Pareto nor total welfare efficient.

Overall, current MIF rates are considered strong-form efficient as no change in the current rates produces a Pareto improvement, which supports hypotheses H1 and H2. Total welfare improvements are possible for some parts of the market under the conditions outlined above, however, in practice, the effect of changes might produce optimal overreaction in

banks and lead to the worse scenarios than those predicted by theory. Hypotheses H3-H5 are supported as well.

5. Supplementary analysis

5.1. Asymmetric interactions between different end-user groups

The analysis above assumes that the interaction between the market participants is symmetric with respect to benefits, in other words, the merchants with average benefits interact with the individuals with average benefits, while median end-user groups interact with each other. In a real life setting the opposite might be true: end users with low benefits value might interact with the merchants with higher benefits value and vice versa. The degree of the asymmetry between end-user groups is yet unknown, however, any market would definitely include the groups with both symmetric and asymmetric (i.e., homogeneous and heterogeneous) end-user interactions unless it is perfectly segmented. Although the determinants of benefits are yet to be researched the preliminary findings suggest that the size of benefits positively correlates with the merchant's size and the income of the cardholder (Krivosheya & Korolev, 2016, 2017). Therefore, one proxy for interactions asymmetry might be the share of the large merchants targeting low-income cardholders in the total share of merchants. However, this data is not easily obtainable either, which is why we present the analysis of both asymmetric and symmetric interactions to provide the comprehensive assessment of the effect of changes. In addition, this approach allows testing the robustness of the results by mitigating the potential effects of overestimation of the merchants' demand at the average benefits value, as explained in the empirical set-up. In order to test the effect of changes in MIF rates on the asymmetric interactions between end-user groups we have reassessed the analysis presented in the previous section using the interplay between the median merchants and average cardholders as well as the median cardholders and average merchants. The results of the analysis are presented in table 4.

Panel A presents the results for the interaction between a median merchant and an average cardholder. There are no situations with a Pareto improvement compared to the status quo. Conceptually, the elasticity of merchants' demand becomes higher in this case as benefits are lower and are at the area where curvature of the ECDF is larger. At the same time, the elasticity of cardholders' demand is lower than in the case of symmetric analysis

(median benefits at both end-user sides). As a result, the magnitude of changes of the cardholders' demand is lower, while it is larger in the acceptance demand of merchants. Hence, when MIF rate decreases there is a larger probability that the total surplus will increase and vice versa. We compare the results with the analysis at average and median values of benefits to assess the robustness of the results.

Tab. 4. Supplementary analysis: asymmetric interactions

	Panel A: Interaction between average individual benefits and median merchant benefits			
	Buyers' surplus (BS)	Sellers' Surplus (SS)	Total Surplus	Volume of transactions
Lower efficiency bound	3.75%	0.05%	3.80%	1.13%
Upper efficiency bound	5.72%	1.07%	6.79%	25.49%
Currently set MIF rates	**5.90%**	**1.39%**	**7.29%**	**27.83%**
Twofold decrease in MIF rates (by 50%)	5.67%	1.71%	7.38%	28.21%
Twofold increase in MIF rates (by 100%)	5.98%	0.77%	6.76%	23.50%
Bedre-Defolie and Calvano (2013) social optimum (Vb=Vs. MIF rates increase by 0.0432)	4.65%	0.05%	4.70%	7.44%
Equality of buyers' benefits and merchants' direct benefits (MIF drops by 0.0307)	5.09%	2.33%	7.42%	28.89%
Equality of buyers' benefits and merchants' direct benefits (MIF drops by 0.0307) using direct benefits demand function of merchants	5.15%	-0.48%	4.67%	30.17%
Currently set MIF rates using direct merchant benefits-based demand function	**5.85%**	**-1.27%**	**4.59%**	**27.28%**
Equality of total buyers' benefits and total merchants' benefits (MIF rises by 0.02443485)	6.84%	0.78%	7.62%	30.41%
MIF drops to 0.2-0.3% (as in EU)	5.40%	2.03%	7.43%	28.95%

Notes: The table presents the robustness checks of the ex-ante evaluation of MIF changes. Panel A presents the estimation at average individuals' benefits and median merchants' benefits values, and panel B - at median individuals' and average merchants' benefits values.

The total surplus indeed changes differently compared to the cases outlined in the main analysis. First, the total surplus decreases with any increase in MIF rates because the changes in the buyers' surplus are not enough to offset the changes in the sellers' surplus. On the other hand, the medium decrease in MIF rates produces social welfare improvement. Notably, the decrease of MIF rates by 0.5-3.5 percentage points changes the sellers' surplus by a larger amount than the buyers' surplus. Maximal total surplus is no longer at the equality of average surpluses but rather closer to the equality of median merchant benefits and average cardholders benefits (a drop in MIF rates by 1.1 percentage points).

Another notable difference is that the buyers' surplus decreases with small or, on the contrary, too large increases in MIF rates. This is explained by the fact that the buyers are worse off because of the fewer places where they can use cashless payments even despite the improved terms or quality of services. This leads to the fact that, unlike in the symmetric analysis at median values of benefits, doubling MIF rates does not increase total welfare. Consumers are also not better off because of the average benefits equality or the MIF increases smaller than 1 percentage point or as high as 5 percentage points. Unlike previously, the decrease in the MIF rates to European levels or by 50% undoubtedly produces social welfare improvement, however, the total surplus of end users never gains more than 0.15 percentage points. As in the analysis at average values of benefits, the sellers' surplus increases with any decreases in MIF rates and decreases with any upward MIF movements. Otherwise, the results are similar to those presented in the main analysis.

Results of the supplementary analysis using the median merchants' benefits support the robustness of the results around Pareto efficiency of current fees. Even if the ECDF computation method is not corrected for the fact that the merchants' benefits are available for the accepting merchants only and produces overestimation, the analysis presented in this part tracks the actual figures of acceptance and card usage more closely and, therefore, supports the robustness of the results. Besides, the surveys support the method robustness.

This analysis also reveals another important finding. The improvement in social welfare largely depends on the part of the market analyzed as well as on the interactions between these parts. Hence, there is not enough evidence to argue that any changes in MIF rates would produce total welfare improvement. Moreover, the optimal overreaction of banks revealed by the surveys and explained in the previous part of the analysis is not ruled out and may happen once the MIF changes are announced. In this case the total welfare of end users may be reduced despite theoretical considerations. The best strategy for the regulator in Russia is, hence, to maintain the status quo and leave the MIF rates unchanged and look for

alternative ways of market stimulation aiming at the isolation of the effects of stimulation on the intended groups of end users only to produce a Pareto improvement (if any) compared to the current situation. Overview and efficiency analysis of the alternative measures is presented in Krivosheya et al. (2015).

To finalize the discussion of the current MIF rates efficiency we have also considered the interaction between the average merchant and median cardholder. Intuitively, this would correspond to a situation when a person with a standard or less than average quality of card product (e.g., an electronic card without a loyalty program) engages in trade with the merchant who has an average contract with the acquirer (e.g., POS terminal supporting contactless payments with the account in the same bank).

Usually the payments products are designed in such a way as to be chosen by a particular user group (e.g., electronic cards are usually chosen by low-income groups, more profitable merchants are more likely to invest in the better payment products). Although further research related to the determinants of benefits size is needed, the initial hypothesis is that income/profitability should correlate positively with the benefits size (Krivosheya & Korolev, 2016, 2017). Hence, it is a more likely situation in the case of an interaction between a lower income individual and a profitable merchant. This situation is less empirically relevant than the case of the symmetric interactions, however, it will help test the robustness of the results found before.

Conceptually, this situation is closer to the symmetric interaction between the median end users than the previous case. Elasticity of merchants' demand is much smaller than that of the cardholders. This leads to the fact that the increase in MIF rates is more likely to produce an improvement in sellers' surplus as well as in the buyers' surplus. The contrary is also true. Intuitively, the increased demand from cardholders offsets the smaller number of merchant locations where cashless payments are accepted and improves the surplus of remaining accepting merchants. This is in fact true for any MIF increase by up to 2 percentage points. Moreover, any decrease in MIF rates results in the decrease of merchant surplus.

As a result, any increase in MIF rates by up to approximately 4 percentage points results in a Pareto improvement compared to the status quo. Note that this result is unlikely to persist in reality due to the optimal overreaction of banks described before as well as the monopolization of acquiring services due to the closure of smaller acquirers with lower profit margins. Moreover, the decrease in acceptance rates is most likely to start with the less profitable merchants. This would also decrease their competitiveness as the individuals use the information about acceptance while choosing a merchant for consumption (Krivosheya &

Korolev, 2016). Therefore, the retail market may also become monopolized and the surpluses may decrease. Yet, theoretically, under perfect pass-through of the changes to end users a Pareto improvement is possible in case the MIF rates increase by some medium amount (up to 4 percentage points). This situation was partially seen in the symmetric analysis at median levels of benefits (for the increase in MIF rate by 0.5-1 percentage points and the equality of total benefits of individuals and merchants). The larger MIF rate range resulting in a Pareto improvement is guaranteed by the larger difference in elasticities of merchants' and cardholders' demand as shown in the theoretical framework and proven in the appendix.

Total welfare also improves similarly to the case of symmetric analysis at median levels of benefits. Unlike before even the more extreme increase in MIF rates (e.g., increase by 5 percentage points) leads to total welfare improvement, which is also explained by the differences in elasticities between merchants' and cardholders' demands. The decreases in MIF rates, on the other hand, distort the total surplus of the end users. The analysis of the subsample of banks with a low share of on-us operations produces similar results and does not contradict previous findings. The results of the estimations are available at request.

Overall, the supplementary analysis supports the robustness of the results. Even though the interaction between the median cardholders and merchants with average benefits points to the situations where some parts of the market might benefit as a result of the MIF changes, these benefits are highly unlikely to exist for all end-user groups, hence, cannot be considered Pareto improving. Moreover, the decrease in MIF rates never results in Pareto improvements and may produce total welfare improvements only under additional assumptions about the interactions of the end users and the degree of pass-through of the changes. Yet, it is the decrease, not the increase in MIF rates that is usually promoted and lobbied to the regulators. In Russia merchants currently file lawsuits and proposals for MIF rate cuts, however, as shown above, it is likely to result in welfare destruction and is not going to result in a Pareto improvement.

All the analyses presented in this study assume the perfect pass-through of the MIF changes to end users. In reality the pass-through may not be perfect. In fact, surveys reveal that, on average, in the case of favorable MIF movements the banks will pass through about 60-80% of the change, while in case of the adverse changes in MIF rates acquirers are likely to pass-through the change in costs completely, while the issuers are likely to optimally overreact and pass-through more than 100% of changes in costs. The imperfect pass-through of favorable changes will further undermine total welfare and is likely to result in the lower increase in social and private surpluses than theoretically predicted. It is, therefore, needed to

be accounted for in any MIF change in order to guarantee that the effect of changes is as intended. However, the pass-through might be dynamic as well. Where the regulator or payment systems assume some level of pass-through by banks, rational issuers and acquirers would realize that the proposed MIF rate change incorporates the assumed pass-through levels. It is better, therefore, to signal or create expectations around the intended pass-through levels in such a way that the proposed MIF rate changes are closer to the privately efficient levels. At the same time there are no regulatory obligations for banks to leave the announced pass-through level unchanged after the actual MIF rate changes.

This creates the possibility of a time-inconsistency problem that is yet to be studied. Because of the differences in information levels about the intended and actual pass-through levels between the banks and the regulators it is possible that the banks will rationally deviate from the announced or signaled pass-through rates and the effects of MIF changes on the welfare will be different from those described in theory. The time inconsistency problem described here may be mitigated by better accounting and reporting of payments business in banks to create more transparency between the regulators and banks, as well as by the innovations such as distributed ledgers (blockchain) to automate the transparent immutable reporting. However, for the full analysis of the effects of a potential time inconsistency problem it may be introduced within the models of payments market equilibrium alongside the information asymmetries rates.

5.2. Direct benefits analysis

In the final section we have relaxed the assumption of perfect information between the merchants and regulators by allowing merchants to exploit the fact that regulators see only direct benefits and cannot calculate the opportunity benefits of each merchant (Krivosheya & Korolev, 2017). To assess the potential effects of information asymmetry we have revisited the analysis using the direct benefits-based demand function. Table 5 presents the results. Panel A repeats the analysis using mean benefits, while panel B uses median benefits.

Tab. 5. Supplementary analysis: Direct merchants' benefits

	Panel A: Analysis at average benefits value using direct benefits-based demand function			
	Buyers' surplus (BS)	Sellers' Surplus (SS)	Total Surplus	Volume of transactions
Lower efficiency bound	3.75%	0.01%	3.76%	1.54%
Upper efficiency bound	6.43%	0.27%	6.70%	34.77%
Currently set MIF rates	**6.48%**	**0.55%**	**7.04%**	**35.48%**
Twofold decrease in MIF rates (by 50%)	6.19%	0.88%	7.07%	35.80%
Twofold increase in MIF rates (by 100%)	6.97%	-0.08%	6.89%	33.89%
Bedre-Defolie and Calvano (2013) social optimum (Vb=Vs. MIF rates increase by 0.0432)	7.62%	-0.89%	6.73%	32.19%
Equality of buyers' benefits and merchants' direct benefits (MIF drops by 0.0307)	5.38%	1.63%	7.01%	35.19%
Equality of total buyers' benefits and total merchants' benefits (MIF rises by 0.02443485)	7.12%	-0.29%	6.83%	33.18%
MIF drops to 0.2-0.3 (as in EU)	5.81%	1.29%	7.10%	36.11%
	Panel B: Analysis at median benefits value using direct benefits-based demand function			
Lower efficiency bound	3.75%	0.00%	3.75%	1.19%
Upper efficiency bound	3.96%	-1.02%	2.93%	18.83%
Currently set MIF rates	**3.96%**	**-0.89%**	**3.07%**	**19.13%**
Twofold decrease in MIF rates (by 50%)	3.77%	-0.33%	3.44%	9.17%
Twofold increase in MIF rates (by 100%)	4.40%	-1.44%	2.96%	22.66%
Bedre-Defolie and Calvano (2013) social optimum (Vb=Vs. MIF rates increase by 0.0432)	4.77%	-1.69%	3.08%	18.80%
Equality of buyers' benefits and merchants' direct benefits (MIF drops by 0.0307)	3.75%	0%	3.75%	0%
Equality of total buyers' benefits and total merchants' benefits (MIF rises by 0.02443485)	4.48%	-1.47%	3.02%	20.68%
MIF drops to 0.2-0.3 (as in EU)	3.75%	0%	3.75%	0%

Notes: The table presents the robustness checks of the ex-ante evaluation of MIF changes using direct merchants' benefits instead of total merchants' benefits. Panel A presents the estimation at average end-user benefits values, while panel B at median end-user benefits values.

The results of the analysis at average benefits value are similar to the results presented in the main part of the research. A notable difference is in the elasticity of the merchants' demand, which becomes larger now. As a result, the magnitude of MIF rates changes required to make the sellers' surplus negative is smaller than when the total benefits-based demand was used. This is also guaranteed by a smaller direct benefits value and the fact that the opportunity benefits constitute the largest share in total merchants' benefits (Krivosheya & Korolev, 2017). There are no Pareto improvement situations, which supports the robustness of the main result around hypothesis 1. Due to the change in relative elasticities a drop in MIF rates by 50% increases the total surplus. This is similarly true for the EU-like regulation when MIF rates become 0.2-0.3%. However, the changes of higher magnitude (e.g., required for the equality of benefits) decrease the total surplus as in the main analysis. Results around total surplus improvement are not robust.

The latter result may be of importance for regulatory decision-making. Building the arguments around the direct benefits merchants can use the total surplus improvement as a justification for the regulatory cut of MIF rates. However, this will produce distortions to total welfare and, especially, to the surplus of the vulnerable groups. Historical regulatory intervention in tariffs may have been inefficient because of the imperfect information between the merchants and regulators.

Median benefits reverse the situation as explained in the main part of the study. Because the median merchants' direct benefits are negative, the surplus becomes negative as well and the regulator starts to solve the loss minimization rather than the surplus maximization problem. Although the instruments are the same, conceptually, these two approaches are different. Nonetheless, a Pareto improvement is still impossible. Total surplus, however, increases whenever the MIF rates are decreased. Larger decreases in MIF rates produce a higher total welfare gain, however, since the individuals median benefits value is also lower than the mean value, only decreases in MIF rates of up to 1.09 percentage points can be sustained. However, once the asymmetric interactions described earlier are introduced, individuals will demand cashless payments even with larger MIF rates decreases.

These results imply that the information asymmetry is another important source for the existence of welfare-destroying policies found in the literature. Having the empirical

mechanism for ex-ante evaluation of the effects of shocks and interventions may mitigate a number of problems discussed above, however, policy makers should be aware of the potential misreporting of the benefits and must ensure that the methods for benefits evaluation are continuously improved and the data reporting is monitored. Otherwise, reporting direct benefits instead of total benefits would result in the promotion of the welfare destroying policies promoted by the empirical mechanisms since the inputs into the mechanisms are inaccurate in this case.

6. Conclusion

This study evaluates the efficiency of currently set MIF rates and the effects of regulatory interventions for the Russian retail payments market. Representative surveys of 800 traditional Russian merchants, 1,500 individuals and 7 banks from the top 20 covering more than 80% of the issuing and acquiring markets allow all the necessary inputs to be obtained for the adopted Bedre-Defolie & Calvano (2013) model. The resulting surpluses obtained for the efficient and current fees indicate that the MIF rates currently chosen by payment systems are within the efficiency bounds and, therefore, should be considered efficient. Besides, the comparative statics analysis shows that the changes to current MIF rates do not result in a Pareto improvement. These findings are robust: results persist when the sample is reduced to the banks with a small share of on-us operations as well as when the mean benefits are changed for the median benefits. The merchants' demand estimated using the direct benefits also keeps the findings unchanged. Less stringent assumptions that help reflect the real market situation better (e.g., imperfect pass-through of changes, information asymmetry) leads to a further distortion of the welfare of end users in case of MIF rates changes. Findings imply that the first-best policy for the regulators is to use alternative (non-tariff) measures for stimulating cashless economy development such as promoting financial literacy, national loyalty programs, standards introduction or acceptance subsidizing that would isolate the effect of changes to the intended groups only.

This research contributes to the rising literature on MIF rates efficiency and the effects of regulatory initiatives (Bedre-Defolie & Calvano, 2013; Bolt et al., 2013; Humphrey, 2010; Jonker et al., 2017; McGinnis, 2012; Rochet & Tirole, 2003, 2006, 2011; Rochet & Wright, 2010; Schmalensee & Evans, 2005; Weiner & Wright, 2005). The theoretical stream of this research, although it serves the basis for the regulatory proposals, does not include all the

real-life market imperfections and specificities at the same time . As a result, the MIF efficiency estimates and the effects of the interventions and shocks may become overly generalized or inadequately measured. At the same time, the empirical analysis in this literature focuses on the ex-post analysis of regulatory initiatives the results of which might not be completely translated to a different market. The created gap results in welfare destroying regulatory initiatives, with theoretical predictions not completely working in practice (Weiner & Wright, 2005; Krivosheya et al., 2015). This study is the first attempt to design an empirical mechanism of MIF efficiency assessment and ex-ante regulatory initiatives analysis. Although there are no empirical mechanisms of ex-ante MIF rates changes assessment yet, the research compliments Krivosheya & Korolev (2016, 2017) by using the estimated end-user benefits to estimate quasi-demands for payments services as well as end-user surpluses and evaluate the efficiency of current MIF rates as well as of changes to the current rates.

Understanding the potential results of the shocks before they happen has two key implications. First, regulators can avoid the decisions which may destroy the sustainable development of the industry and the economy as a whole because MIF regulation is usually time-consuming and a long-term oriented policy, which is not easy to reverse. Secondly, the mechanism, which is based on end-user surpluses rather than the costs, incorporates the economic foundations of the market and is more transparent compared to the accounting concepts of cost balance in the issuing and acquiring banks. Payment business is usually accounted for within a more general framework and does not constitute the separate P&L line. Besides, bank costs data is sensitive and may be collected in a valid way only because of an independent cost study procedure initiated by the payment system or the regulator. Information asymmetry regarding the costs of the banks is a source of mistrust and speculation of some end-user groups, which with the sufficient lobbying power may result in the regulatory proposals. Benefits values, unlike costs, are not sensitive and may be collected in a valid form using sociological methods. This decreases the potential costs associated with MIF efficiency assessment and the communication of the results of such assessment. The benefits-based mechanism is a toolbox for academics and practitioners to address effectively the development of the retail payments market by analyzing the effect of various policies and shocks introduced to the market before they are actually implemented.

In addition, this study contributes to the burgeoning literature concerning the emerging retail payments and financial markets (Chizhikova et al., 2013; Reinartz et al., 2011). Understanding the efficiency and potential changes to the welfare of end users may help to

expose the reasons for the differences in the developed and developing financial markets. For instance, the Russian retail payments market offers stimulating programs in the majority of banks, while European and the US banks are less prone to rewarding customers in monetary equivalents, which is a direct result of MIF rates choice.

In the light of current criticism of the MIF rates in Russia mainly by merchants the main practical and social implication of this research is to understand the necessity and desirability of any regulatory intervention before it is implemented. The analysis of the changes in end-user surpluses also show the interdependence of welfare at the different sides of the market due to indirect network externalities. Because of this interdependence the issuing side of payments business cannot be considered separately from the acquiring side and vice versa, in the context of the effect of changes. The indirect effects are especially important for the interaction of the groups with different benefits values, i.e. lower benefits individuals and higher benefits merchants or vice versa. Such interaction may be considerable for some markets (e.g., profitable large retailer targeting the lower-end product segment), hence, the arguments and proposals made by retailers can never be considered without the analysis of the effects on individuals and vice versa.

Payment systems are often criticized for setting the MIF rates too high in order to attract the issuers and stimulate transaction volumes, which would increase their revenues captured in the form of license fees (Schmalensee & Evans, 2005). This research shows that even though there was no regulatory intervention, MIF rates set by payments system may be justified by the economics of the payments market and considered efficient. Empirical ex-ante evaluation of the effect of changes in MIF rates is a step towards the introduction of fair pricing of payment instruments and implementation of effective policies in Russia as well as globally. Other markets may adopt the mechanism using their own benefits estimates or apply the results of this study should institutional characteristics of their retail payments market be similar to Russian ones and the benefits estimates not immediately available. This research also stresses the importance of modeling and investigating the effects of more advanced assumptions about the behavior of agents at the retail payments market. For instance, the degree of pass-through, the time inconsistency problem of the pass-through decisions, the changing market structure and the information asymmetry are the market imperfections that may dramatically influence the outcome of the MIF efficiency and regulation and provide further insights into the behavior of end users as well as banks and payment systems. Finally, the research shows the importance of analyzing the different groups in the market. The more vulnerable groups react differently to the market-wide changes compared to the average end

users. This result invites the creation and usage of alternative measures for stimulation of the cashless economy (Krivosheya et al., 2015).

As any other study, this research has a number of limitations that suggest a direction for further research. First, the merchants' benefits are available only for the accepting merchants. Evaluation of the potential benefits of non-accepting merchants may result in more precise estimates of the quasi-demand for merchants. Although it does not affect the key analysis in this study for purposes like the exact monetary valuation of the end-user surplus these estimates might be of particular importance. It would also be interesting to see the dynamics of the benefits and potential changes to MIF rates efficiency through time. Although the market situation has not changed significantly, the introduction of new solutions such as the FinTechs or POS modernization may have changed the benefits value. Besides, additional merchant segments (e.g., e-commerce, gasoline, transport) may be added. Secondly, a number of results demonstrate the importance of understanding the magnitude of the network externalities in the Russian retail payments market. For some results (e.g., the existence of a Pareto improvement) measuring the indirect network effects might be both cost and time efficient compared with the conduct of the national survey of individuals and merchants. The results presented in the appendix may be used as a sufficient condition for the existence of the Pareto improving regulation and, therefore, be an additional tool for the ex-ante assessment of the regulatory initiatives and other market shocks. Besides, although the effect of the additional market imperfections is hypothesized (e.g., information asymmetry, imperfect pass-through) formal analysis and modeling of these imperfections may provide additional insights. Finally, other countries' and cross-country benefits may be of interest for the creation of a universal method of ex-ante shocks assessment. Moreover, the approaches of this empirical research may be used in the context of other marketplaces and two-sided markets which work with the fees as the balancing tools. The number of such markets has increased over the past decades. Understanding the effect of regulation may provide grounds for swifter regulatory decisions not only in the financial context but also for new startups and technologies and economy-wide initiatives.

References

Ahuja, N. (2008). Interchange Fees and Credit Card Issuing: An Empirical Investigation.

Arango, C. A., Huynh, K. P., & Sabetti, L. (2011). *How Do You Pay? The Role of Incentives at the Point-of-Sale* (SSRN Scholarly Paper No. ID 1932620). Rochester, NY: Social Science Research Network.

Arango, C., & Taylor, V. (2008). *Merchant Acceptance, Costs, and Perceptions of Retail Payments: A Canadian Survey* (Discussion Paper No. 08–12). Bank of Canada.

Arango-Arango, C. A., Bouhdaoui, Y., Bounie, D., Eschelbach, M., & Hernandez, L. (2018). Cash remains top-of-wallet! International evidence from payment diaries. *Economic Modelling*, *69*, 38–48.

Ardizzi, G. (2013). Card versus cash: empirical evidence of the impact of payment card interchange fees on end users' choice of payment methods. *Journal of Financial Market and Infrastructures, 1*(4), 73-105

Baxter, W. F. (1983). Bank Interchange of Transactional Paper: Legal and Economic Perspectives. *The Journal of Law & Economics*, *26*(3), 541–588.

Bedre-Defolie, Ozlem, & Calvano, E. (2013). Pricing Payment Cards. *American Economic Journal: Microeconomics*, *5*(3), 206–231.

Bolt, W., Jonker, N., & Plooij, M. (2013). *Tourist Test or Tourist Trap? Unintended Consequences of Debit Card Interchange Fee Regulation* (SSRN Scholarly Paper No. ID 2369799). Rochester, NY: Social Science Research Network.

Bolt, W., & Mester, L. J. (2017). Introduction to Retail Payments: Mapping Out the Road Ahead. *Journal of Financial Services Research*, *52*(1–2), 1–3.

Bounie, D., François, A., & Hove, L. V. (2016). Consumer Payment Preferences, Network Externalities, and Merchant Card Acceptance: An Empirical Investigation. *Review of Industrial Organization*, 1–34.

Bounie, D., François, A., & Van, H. L. (2016). Merchant Acceptance of Payment Cards: "Must Take" or "Wanna Take"? *Review of Network Economics*, *15*(3), 117–146.

Carbo-Valverde, S., & Liñares-Zegarra, J. M. (2012). *Payment Card Interchange Fees: Assessing the Effectiveness of Antitrust Investigations and Regulation in Europe* (SSRN Scholarly Paper No. ID 2052056). Rochester, NY: Social Science Research Network.

Carbó-Valverde, S., Liñares-Zegarra, J. M., & Rodríguez-Fernández, F. (2012). Feedback Loop Effects in Payment Card Markets: Empirical Evidence. *Review of Network Economics*, *11*(2).

Chakravorti, S., & Roson, R. (2006). Platform competition in two-sided markets: The case of payment networks. *Review of Network Economics*, *5*(1).

Chang, H., Evans, D. S., & Garcia, S. D. D. (2005). The Effect of Regulatory Intervention in Two-Sided Markets: An Assessment of Interchange-Fee Capping in Australia. *Review of Network Economics*, *4*(4).

Chernikova, L. I., Faizova, G. R., Egorova, E. N., & Kozhevnikova, N. V. (2015). Functioning and Development of Retail Banking in Russia. *Mediterranean Journal of Social Sciences*, *6*(6 S4), 274.

Ching, A. T., & Hayashi, F. (2010). Payment card rewards programs and consumer payment choice. *Journal of Banking & Finance*, *34*(8), 1773–1787.

Delgado Miguel A., & Robinson Peter M. (2006). Nonparametric and semiparametric methods for economic research. Journal of Economic Surveys, 6(3), 201–249.

Dvoretzky, A., Kiefer, J., & Wolfowitz, J. (1956). Asymptotic minimax character of the sample distribution function and of the classical multinomial estimator. *The Annals of Mathematical Statistics*, 642-669.

Evans, D. S. (2011). *Payments Innovation and Interchange Fees Regulation: How Inverting the Merchant-Pays Business Model Would Affect the Extent and Direction of Innovation* (SSRN Scholarly Paper No. ID 1878825). Rochester, NY: Social Science Research Network.

Evans, D. S., Chang, H., & Joyce, S. (2015). The Impact of the U.S. Debit-Card Interchange Fee Regulation on Consumer Welfare. *Journal of Competition Law & Economics*, *11*(1), 23–67.

Evans, D. S., Litan, R. E., & Schmalensee, R. (2011). *The Economic Principles for Establishing Reasonable Regulation of Debit-Card Interchange Fees that Could Improve Consumer Welfare* (SSRN Scholarly Paper No. ID 1769890). Rochester, NY: Social Science Research Network.

Evans, D. S., & Mateus, A. M. (2011). *How Changes in Payment Card Interchange Fees Affect Consumers Fees and Merchant Prices: An Economic Analysis with Applications to the European Union* (SSRN Scholarly Paper No. ID 1878735). Rochester, NY: Social Science Research Network.

Gans, J. S., & King, S. P. (2003). Approaches to Regulating Interchange Fees in Payment Systems. *Review of Network Economics*, *2*(2).

Guthrie, G., & Wright, J. (2007). Competing Payment Schemes. *The Journal of Industrial Economics*, *55*(1), 37–67.

Hasan, I., Schmiedel, H., & Song, L. (2012). Returns to Retail Banking and Payments. *Journal of Financial Services Research*, *41*(3), 163–195.

Humphrey, D. B. (2010). Retail payments: New contributions, empirical results, and unanswered questions. *Journal of Banking & Finance*, *34*(8), 1729–1737.

Jonker, N., & Plooij, M. A. (2013). Tourist Test interchange fees for card payments: down or out. *Journal of Financial Market Infrastructures*, *1*(4), 51–72.

Jonker, N., Plooij, M., & Verburg, J. (2017). Did a Public Campaign Influence Debit Card Usage? Evidence from the Netherlands. *Journal of Financial Services Research*, *52*(1–2), 89–121.

Jonkers, N. (2011). Card Acceptance and Surcharging: the Role of Costs and Competition. *Review of Network Economics*.

Kay, B., Manuszak, M. D., & Vojtech, C. M. (2014). *Bank Profitability and Debit Card Interchange Regulation: Bank Responses to the Durbin Amendment* (SSRN Scholarly Paper No. ID 2976985). Rochester, NY: Social Science Research Network.

Khan, J., Belk, R. W., & Craig-Lees, M. (2015). Measuring consumer perceptions of payment mode. *Journal of Economic Psychology*, *47*, 34–49.

Kontorovich, A., & Weiss, R. (2014). Uniform Chernoff and Dvoretzky-Kiefer-Wolfowitz-type inequalities for Markov chains and related processes. *Journal of Applied Probability*, *51*(4), 1100-1113.

Koulayev, S., Rysman, M., Schuh, S., & Stavins, J. (2016). Explaining adoption and use of payment instruments by US consumers. *The RAND Journal of Economics*, *47*(2), 293–325.

Krivosheya, E., Korolev, A., & Plaksenkov, E. (2015). Measures for stimulating a cashless economy in Russia. *Moscow School of Management SKOLKOVO Working Paper*.

Krivosheya, E., & Korolev, A. (2016). Benefits of the retail payments card market: Russian cardholders' evidence. *Journal of Business Research*, *69*(11), 5034–5039.

Krivosheya, E., & Korolev, A. (2017). Benefits of the retail payments card market: Evidence from Russian merchants. *Journal of Business Research*.

Loke, Y. J. (2007). Determinants of Merchant Participation in Credit Card Payment Schemes. *Review of Network Economics*, *6*(4).

Massart, P. (1990). The tight constant in the Dvoretzky-Kiefer-Wolfowitz inequality. *The annals of Probability*, *18*(3), 1269-1283.

Malaguti, M. C., & Guerrieri, A. (2014). Multilateral Interchange Fees: Competition and regulation in light of recent legislative developments. ECRI Research Report No. 14.

McGinnis, P. C. (2012). Misguided Regulation of Interchange Fees: The Consumer Impact of the Durbin Amendment. *Loyola Consumer Law Review*, *25*, 285.

Plaksenkov, E., Korovkin, V., & Krivosheya, E. (2015). Cashless economy in Russia: Tendencies, perspectives, opportunities. *Moscow School of Management SKOLKOVO Working Paper*.

Reinartz, W., Dellaert, B., Krafft, M., Kumar, V., & Varadarajan, R. (2011). Retailing Innovations in a Globalizing Retail Market Environment. *Journal of Retailing*, *87*, *Supplement 1*, S53–S66.

Rochet, J.-C., & Tirole, J. (2002). Cooperation among Competitors: Some Economics of Payment Card Associations. *The RAND Journal of Economics*, *33*(4), 549–570.

Rochet, J.-C., & Tirole, J. (2003). Platform Competition in Two-sided Markets. *Journal of the European Economic Association*, *1*(4), 990–1029.

Rochet, J.-C., & Tirole, J. (2006). Two-sided markets: a progress report. *The RAND Journal of Economics*, *37*(3), 645–667.

Rochet, J.-C., & Tirole, J. (2011). Must-Take Cards: Merchant Discounts and Avoided Costs. *Journal of the European Economic Association*, *9*(3), 462–495.

Rochet, J.-C., & Wright, J. (2010). Credit card interchange fees. *Journal of Banking & Finance*, *34*(8), 1788–1797.

Schmalensee, R., & Evans, D. S. (2005). *The Economics of Interchange Fees and their Regulation: An Overview* (SSRN Scholarly Paper No. ID 744705). Rochester, NY: Social Science Research Network.

Schmalensee Richard. (2003). Payment Systems and Interchange Fees. *The Journal of Industrial Economics*, *50*(2), 103–122.

Snellman, J. S., Vesala, J. M., & Humphrey, D. B. (2001). Substitution of Noncash Payment Instruments for Cash in Europe. *Journal of Financial Services Research*, *19*(2–3), 131–145.

Tirole, J. (2011). Payment card regulation and the use of economic analysis in antitrust. *TSE Notes/Notes TSE*, *4*.

Tsay, R. S. (2016). Some Methods for Analyzing Big Dependent Data. *Journal of Business & Economic Statistics*, *34*(4), 673–688.

Valverde, S. C., Chakravorti, S., & Fernández, F. R. (2015). The Role of Interchange Fees in Two-Sided Markets: An Empirical Investigation on Payment Cards. *Review of Economics and Statistics*.

Verdier, M. (2011). Interchange Fees in Payment Card Systems: A Survey of the Literature. *Journal of Economic Surveys*, *25*(2), 273–297.

Walls, W. D. (2010). Superstars and heavy tails in recorded entertainment: empirical analysis of the market for DVDs. *Journal of Cultural Economics*, *34*(4), 261–279.

Wang, Z. (2013). *Debit Card Interchange Fee Regulation: Some Assessments and Considerations* (SSRN Scholarly Paper No. ID 2266079). Rochester, NY: Social Science Research Network.

Weiner, S., & Wright, J. (2005). Interchange Fees in Various Countries: Developments and Determinants. *Review of Network Economics*, *4*(4), 1–34.

Wright Julian. (2004). The Determinants of Optimal Interchange Fees in Payment Systems. *The Journal of Industrial Economics*, *52*(1), 1–26.

Ye Sudong, & Tiong Robert L. K. (2000). NPV-at-Risk Method in Infrastructure Project Investment Evaluation. *Journal of Construction Engineering and Management*, *126*(3), 227–233.

Zenger, H. (2011). Perfect surcharging and the tourist test interchange fee. *Journal of Banking & Finance*, *35*(10), 2544–2546.

Appendix: Proof of proposition 1

The only difference between the social (total) welfare improvement and the Pareto improvement is the set of the constraints used by the regulator upon the choice of efficient MIF rates. Otherwise, the analyses are fully equivalent. In order for the social welfare improvement to occur the benevolent social planner must ensure that

$$\frac{\partial W}{\partial a} = \frac{\partial\{([(f+m-c)+v_B(f)+v_S(m)]D_B(f)D_S(m)+E[B_B|B_B\geq F-\Phi_B])Q(F-\Phi_B)\}}{\partial a},$$

where W is the social welfare function under the Bedre-Defolie & Calvano (2013) assumptions and notations and a are the MIF rates. Bedre-Defolie and Calvano (2013) demonstrate that the maximum social welfare attains at the equality of the average buyers and sellers net benefits ($v_S(m^{FB}) = v_B(f^{FB})$). Hence, the MIF rate changes will bring the social welfare improvement if and only if the benefits gap decreases (difference between buyers' and sellers' benefits is diminished). In other words, if the average merchants' benefits are higher than the average cardholders' benefits an increase in MIF rates will bring about a social welfare improvement.

The surveys show that the changes in the fixed fees and, hence, fixed benefits as well as the number of cardholders is insignificant. Therefore, we may assume that only the acceptance and the payment decisions (i.e., $[(f+m-c)+v_B(f)+v_S(m)]D_B(f)D_S(m)$) are affected as a result of MIF changes. Hence, solving the equation above under these assumptions:

$$\frac{\partial W}{\partial a} = \{(\frac{\partial f}{\partial a}+\frac{\partial m}{\partial a})D_BD_S + \frac{\partial v_B(f)}{\partial a}D_BD_S + \frac{\partial v_S(m)}{\partial a}D_BD_S + [(f+m-c)+v_B + v_S](\frac{\partial D_B(f)}{\partial a}D_S + \frac{\partial D_S(m)}{\partial a}D_B)\}Q(F-\Phi_B)$$

Under the assumption of the perfect pass-through, which is intended by the MIF regulation $\frac{\partial f}{\partial a} = \frac{\partial m}{\partial a}$. For the social welfare to occur, therefore, the following must hold true:

$$\frac{\partial W}{\partial a} = \left\{\frac{\partial v_B(f)}{\partial a}D_BD_S + \frac{\partial v_S(m)}{\partial a}D_BD_S + [(f+m-c)+v_B+v_S]\left(\frac{\partial D_B(f)}{\partial a}D_S + \frac{\partial D_S(m)}{\partial a}D_B\right)\right\}Q(F-\Phi_B) \geq 0$$

With the perfect pass-through at both sides (issuers and acquirers) $\frac{\partial v_B(f)}{\partial a} = -\frac{\partial v_S(m)}{\partial a}$ must also be true, i.e., the change in the cardholders' variable fees (or loyalty programs and the quality of services) is equivalent to the change in merchant discount fees assuming that the gross benefits are unchanged as a result of changes in MIF rates (e.g., there are no changes

to market structure, financial literacy levels, fixed fees etc.). Hence, the problem becomes equivalent to:

$$\frac{\partial W}{\partial a} = \{\frac{\partial D_B(f)}{\partial a} D_S + \frac{\partial D_S(m)}{\partial a} D_B\} \geq 0.$$

Let's define $E_a^{D_B} \equiv \frac{\partial D_B(f)}{\partial a} \frac{a}{D_B(f)}$ as the elasticity of cardholders' demand to changes in MIF rates and $E_a^{D_S} \equiv \frac{\partial D_S(m)}{\partial a} \frac{a}{D_S(m)}$ as the elasticity of merchants' demand to changes in MIF rates. These two elasticities are always of opposite signs. Rearranging the terms in the equation above we can derive $\frac{\partial W}{\partial a} = E_a^{D_B} + E_a^{D_S} \geq 0$. In other words, social welfare improvement is possible, if and only if, $E_a^{D_B} \geq -E_a^{D_S}$. Under the assumption of the perfect pass-through and the equivalent pass-through at both market sides this is also equivalent to $E_{v_B}^{D_B} \geq -E_{v_S}^{D_S}$ and $E_{v_S}^{D_B} \geq -E_{v_B}^{D_S}$, which are the proxies for the direct and indirect network externalities.

Under the same set of assumptions, the conditions for a Pareto improvement are $\frac{\partial BS}{\partial a}, \frac{\partial SS}{\partial a} \geq 0$ or $\begin{cases} \frac{\partial v_B}{\partial a} D_B D_S + \frac{\partial D_B}{\partial a} D_S v_B + \frac{\partial D_S}{\partial a} D_V v_B \geq 0 \\ \frac{\partial v_S}{\partial a} D_B D_S + \frac{\partial D_B}{\partial a} D_S v_S + \frac{\partial D_S}{\partial a} D_V v_S \geq 0 \end{cases}$.

Rearranging the terms in a similar way as before yields

$$\begin{cases} E_a^{D_B} + E_a^{D_S} \geq -\frac{a}{v_B} \frac{\partial v_B}{\partial a} \\ E_a^{D_B} + E_a^{D_S} \geq -\frac{a}{v_S} \frac{\partial v_S}{\partial a} \end{cases}.$$

Under the perfect pass-through assumption this can be rewritten as

$$\begin{cases} E_a^{D_B} + E_a^{D_S} \geq \frac{a}{v_B} \\ E_a^{D_B} + E_a^{D_S} \geq -\frac{a}{v_S} \end{cases}.$$

Only one of the conditions is important in the analysis since when one is satisfied, the other is automatically satisfied as well. For positive values of MIF rates (when the issuer is reimbursed by the acquirer) and positive mean benefits of the cardholders and sellers, the former equation is important. If the MIF rates or the benefits are negative, the latter equation is important. Either way, it is evident that the condition required for a Pareto improvement is more stringent than the one for the social welfare improvement. It is enough to have at least the same elasticities or a larger elasticity of one of the end-user group's demand to obtain a social welfare improvement. For a Pareto improvement the difference in elasticities should be enough to offset some constant.

If the assumptions of the perfect pass-through, ideal information and the symmetric pass-through are relaxed the computations become more difficult and the results cannot be expressed in the forms other than the MIF elasticity of end-user demand, however, the main result is intact - a Pareto improvement requires larger elasticity difference than the social welfare improvement. Hence, as proposed, a Pareto improvement using the MIF rates is possible if and only if there are large imbalances between the end-user benefits.

Tab. 3. Comparative statics: the effect of changes on the end-user surpluses

	Panel A: Estimation at average benefits values					
	Individuals' Benefits	Merchants' Benefits	Buyers' surplus (BS)	Sellers' Surplus (SS)	Total Surplus	Volume of transactions
Currently set MIF rates	**7.70%**	**16.34%**	**6.65%**	**6.15%**	**12.80%**	**37.61%**
Twofold decrease in MIF rates (by 50%)	6.81%	17.39%	6.26%	6.42%	12.68%	36.90%
Twofold increase in MIF rates (by 100%)	9.49%	14.63%	7.25%	5.40%	12.65%	36.90%
Bedre-Defolie and Calvano (2013) social optimum (Vb=Vs. MIF rates increase by 0.0432)	12.02%	12.02%	8.37%	4.61%	12.98%	38.38%
Equality of buyers' benefits and merchants' direct benefits (MIF drops by 0.0307)	4.63%	19.41%	5.40%	6.91%	12.31%	35.59%
Equality of buyers' benefits and merchants' direct benefits (MIF drops by 0.0307) using direct benefits demand function of merchants	4.63%	4.63%	5.38%	1.63%	7.01%	35.19%
Currently set MIF rates using direct merchant benefits-based demand function	**7.70%**	**1.56%**	**6.48%**	**0.55%**	**7.04%**	**35.48%**
Equality of total buyers' benefits and total merchants' benefits (MIF rises by 0.02443485)	10.14%	13.90%	7.62%	5.30%	12.92%	38.15%
MIF drops to 0.2-0.3 (as in EU)	5.70%	18.34%	5.84%	6.72%	12.57%	36.66%
	Panel B: Estimation at median benefits values					
	Individuals' Benefits	Merchants' Benefits	Buyers' surplus (BS)	Sellers' Surplus (SS)	Total Surplus	Volume of transactions
Currently set MIF rates	**1.09%**	**5.00%**	**3.97%**	**0.98%**	**4.94%**	**19.51%**
Twofold decrease in MIF rates (by 50%)	0.20%	6.05%	3.77%	0.55%	4.32%	9.12%
Twofold increase in MIF rates (by 100%)	2.88%	3.29%	4.37%	0.71%	5.08%	21.58%
Bedre-Defolie and Calvano (2013) social optimum (Vb=Vs. MIF rates increase by 0.0432)	5.41%	0.68%	4.12%	0.05%	4.17%	6.77%

Equality of buyers' benefits and merchants' direct benefits (MIF drops by 0.0307)	-1.98%	8.07%	3.75%	0%	3.75%	0%
Equality of buyers' benefits and merchants' direct benefits (MIF drops by 0.0307) using direct benefits demand function of merchants	-1.98%	-1.58%	3.75%	0%	3.75%	0%
Currently set MIF rates using direct merchant benefits-based demand function	**1.09%**	**-4.65%**	**3.96%**	**-0.89%**	**3.07%**	**19.13%**
Equality of total buyers' benefits and total merchants' benefits (MIF rises by 0.02443485)	3.53%	2.56%	4.74%	0.72%	5.46%	28.07%
MIF drops to 0.2-0.3 (as in EU)	-0.91%	7.00%	3.75%	0%	3.75%	0%

	Panel C: Estimation at average benefits values (subsample of banks without a high share of on-us transactions)					
	Individuals' Benefits	Merchants' Benefits	Buyers' surplus (BS)	Sellers' Surplus (SS)	Total Surplus	Volume of transactions
Currently set MIF rates	**7.70%**	**16.34%**	**6.65%**	**6.15%**	**12.80%**	**37.61%**
Twofold decrease in MIF rates (by 50%)	5%	18.10%	5.70%	6.64%	12.34%	36.65%
Twofold increase in MIF rates (by 100%)	12.48%	12.81%	8.54%	4.92%	13.46%	38.38%
MIF drops to 0.2-0.3 (as in EU)	3.10%	20.94%	4.86%	7.49%	12.36%	35.79%

	Panel D: Estimation at median benefits values (subsample of banks without a high share of on-us transactions)					
	Individuals' Benefits	Merchants' Benefits	Buyers' surplus (BS)	Sellers' Surplus (SS)	Total Surplus	Volume of transactions
Currently set MIF rates	**1.09%**	**5.00%**	**3.97%**	**0.98%**	**4.94%**	**19.51%**
Twofold decrease in MIF rates (by 50%)	-1.30%	6.76%	3.75%	0%	3.75%	0%
Twofold increase in MIF rates (by 100%)	5.87%	1.47%	4.49%	0.19%	4.68%	12.62%
MIF drops to 0.2-0.3 (as in EU)	-3.51%	9.60%	3.75%	0%	3.75%	0%

Notes: The table presents the results of the ex-ante evaluation of MIF changes. Panel A presents the estimation at average benefits values, and panel B, at median end-user benefits values. Panels C and D repeat the analysis for the subsample of banks without a large share of on-us transactions.

Egor A. Krivosheya
Moscow School of Management SKOLKOVO. Financial Innovations and Cashless Economy Centre. National Research University Higher School of Economics. School of Finance.
E-mail: Egor_Krivosheya@skolkovo.ru, Tel. +7 (495) 539-30-03