Socioeconomic Impact of Electronic Payments in Germany

September 2024

Building a better working world

This study was commissioned by Mastercard and was conducted independently by EY.

Contents

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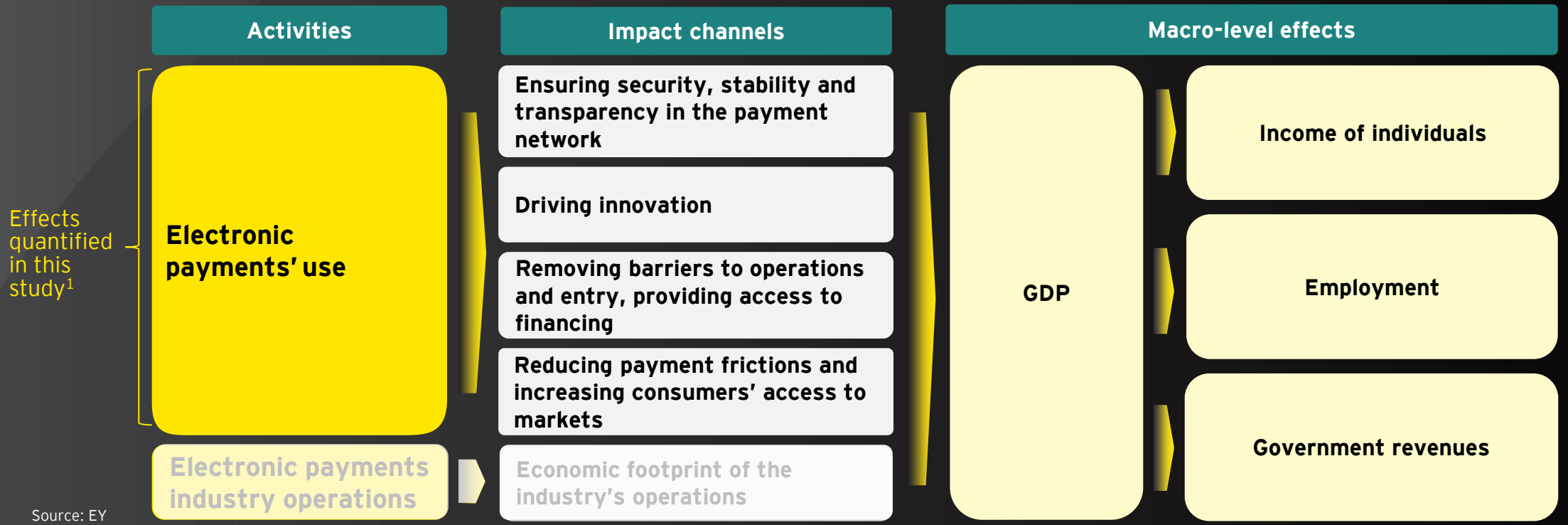
EXECUTIVE SUMMARY

Electronic payments' impact on the German economy and society can be considered for two types of activities

- **Electronic payments'[1] USE by different entities**, through the transformative impact channels that include security, innovation, providing access to financing and markets, and reducing payment frictions – a key activity for the socioeconomic influence of electronic payments and focus of this research.[1]
- **Electronic payments industry OPERATIONS**, including not only the value of goods and services produced, jobs generated or taxes paid by the industry itself, but also the impact on the industry's supply chain and their employees – economic effects generated in this way are much smaller and not calculated in this study.[2]

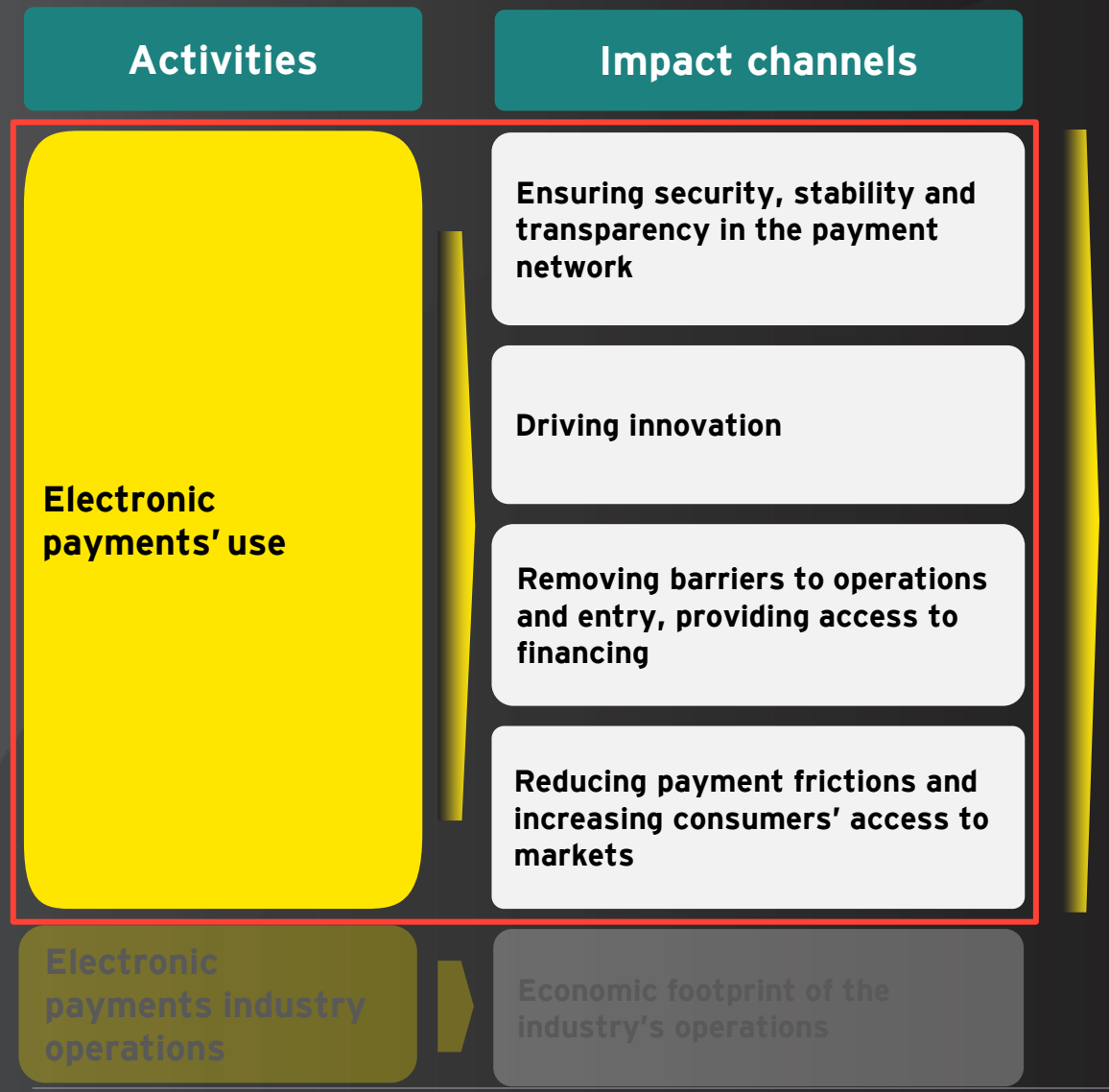


Source: EY

[1] **Economic effects generated through this channel** have been estimated with an econometric model. In **addition to this document**, we have provided **technical appendices** with details on the applied methodology and used data sources.

[2] Economic impact of electronic payments industry operations can be estimated with an input-output model and the industry's data. EY estimated such effects, e.g., in a similar study for the US economy.

Electronic payments' use contributed in Germany to EUR 127bn of GDP, EUR 934 of individual annual income, 1.3m jobs and EUR 52bn of tax revenues in 2023



Impact of electronic payments' use on the German economy in 2023:

GDP
EUR 127bn

Individual annual income
EUR 934

Employment
1.3m jobs

Tax revenues[1]
EUR 52bn

correspond to

Share of the domestic economic activity[2]
3.1%

The figures represent the aggregate, multichannel impact of electronic/card payments. Due to the high correlations among popularity of various forms of electronic payments, e-commerce, and related activities, it is difficult to distinguish their individual contributions. Since every econometric analysis based on observational data is subject to uncertainty, especially in terms of causality, these estimates should be interpreted with caution, as indicative of the scale of impact.

Source: EY calculations.

[1] Tax revenues refers to the total tax and social contribution receipts; due to the lack of 2023 data we assumed the same share of taxes in GDP in 2023 as in 2022. [2] Our econometric analysis showed that electronic payments generated about 3.1% of GDP in 2023 in Germany. Estimated effects on GDP were translated into effects for employment, individual income and tax revenues using the average ratios between GDP and these variables in the analysed country. In such approach the shares of such effects in totals for the whole economy are the same (3.1%),

The economic impact of electronic payments' use may be summarized in the form of multipliers

- Despite the significant growth of card and other electronic payments in Germany since 2018, their use **remains lower than in most EU countries**, indicating **potential for further improvement** and additional positive socioeconomic effects.

1% increase in the value of electronic payments' use[2]

Increase in the German economic activity:[1]

GDP	Individual annual income
EUR 1.3bn	EUR 9.5

Employment	Tax revenues
13.5k	EUR 0.5bn

Source: EY calculations.

[1] Annual values (annual average for employment), values in EUR are presented in 2023 prices. See also footnotes on the previous page.

[2] 1% increase in the value of electronic (card) payments relative to the total value of households' consumption. Under certain assumptions, the results are scalable – e.g., to determine the impact of a 10% change, multiply the figures above by 10.

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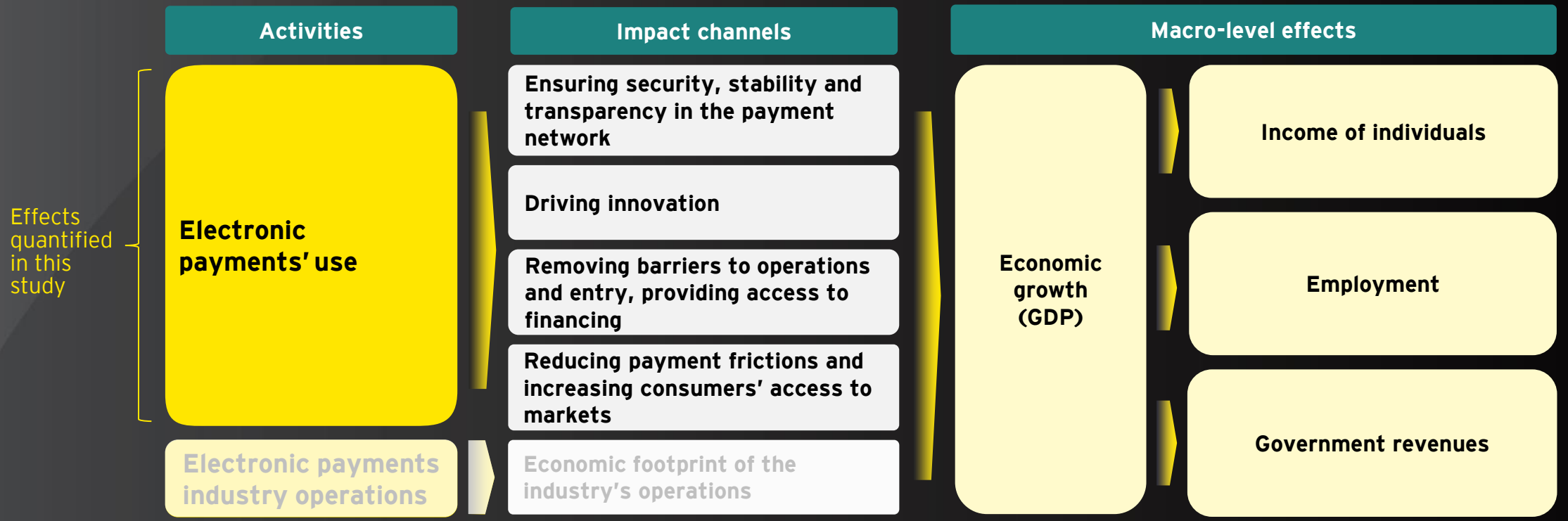
HOW ELECTRONIC PAYMENTS IMPACT THE ECONOMY AND SOCIETY?

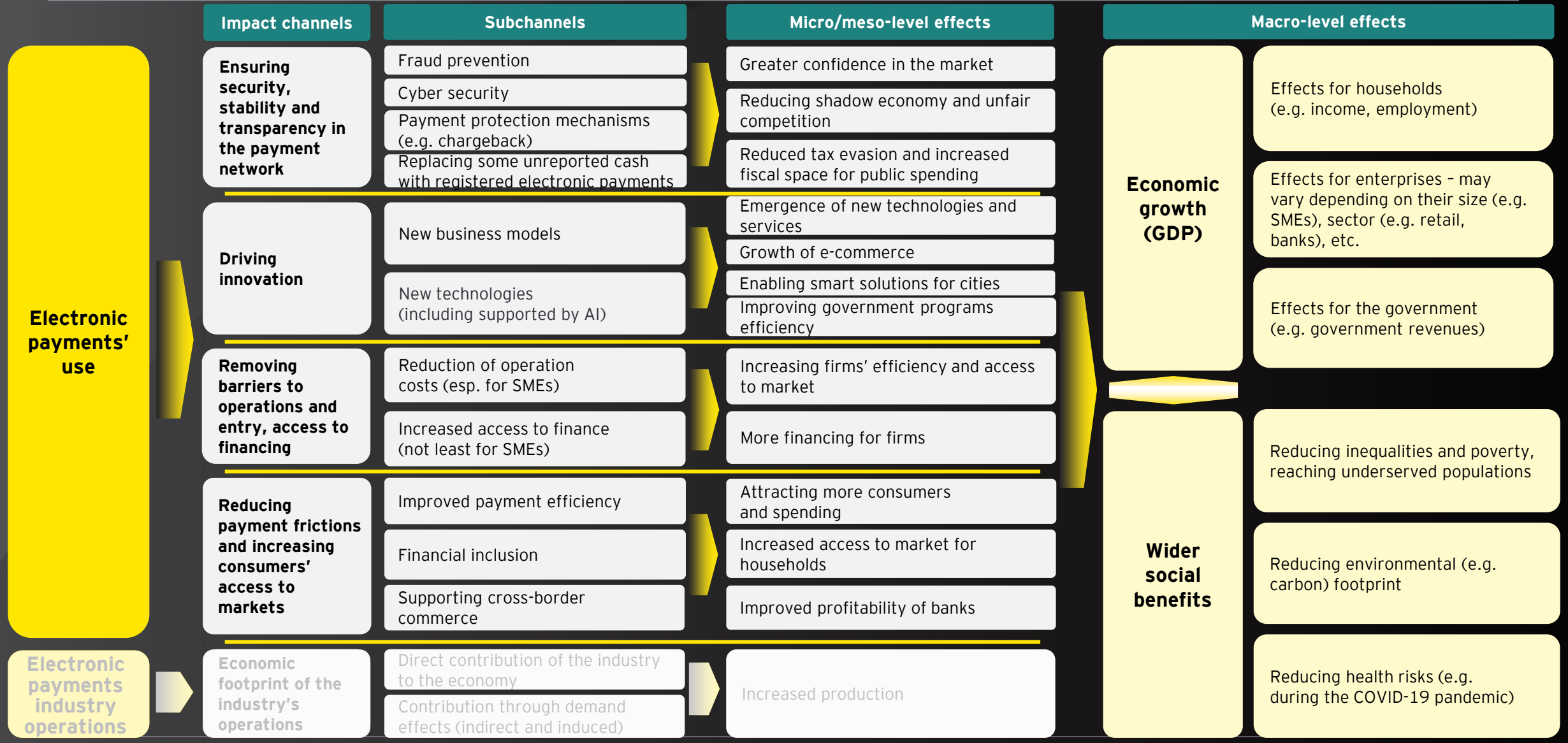
Electronic payments impact the German economy and society through two types of activities and different channels

- **Electronic payments' USE by different entities**, through the transformative impact channels that include security, innovation, providing access to financing and markets, and reducing payment frictions
- **Electronic payments industry OPERATIONS**, including not only the value of goods and services produced, jobs generated or taxes paid by the industry, but also the impact on the industry's supply chain and their employees



Source: EY

We mapped detailed channels and effects on the German economy and society based on the literature review



Source: EY

2

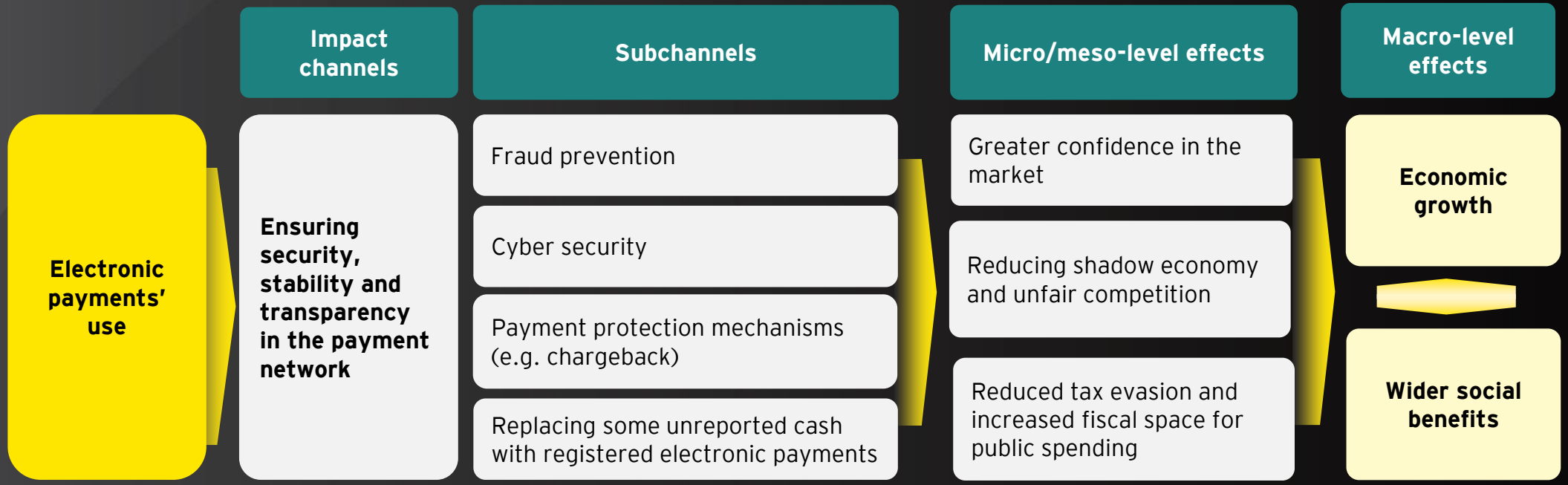
HOW ELECTRONIC PAYMENTS IMPACT THE ECONOMY AND SOCIETY?

2.1

Ensuring security, stability and transparency in the payment network

Security, stability and transparency in the payment network provides important benefits for the economy and society (1/2)

- The *Ensuring security, stability and transparency in the payment network* channel impacts the economy and society via specific subchannels, such as fraud prevention, cyber security, payment protection mechanisms and replacing some unreported cash with registered electronic payments, resulting in:
  - Micro/meso-level effects – such as increasing confidence in the market and reducing the shadow economy
  - Macro-level effects – i.e. stimulating economic growth and additional social benefits (which may influence each other)

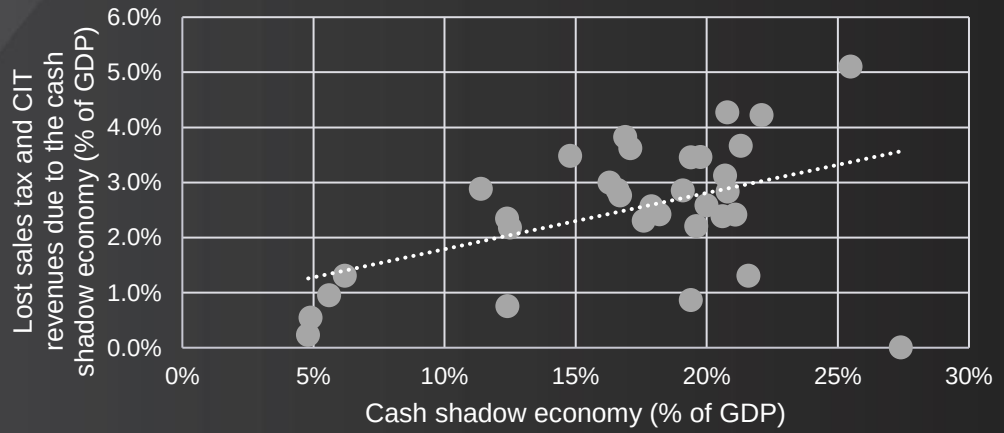


Source: EY

Security, stability and transparency in the payment network provides important benefits for the economy and society (2/2)

- **Cashless payments ensure that funds are smoothly transferred from one party to another allowing more transactions to be closed.** There are several reasons for why electronic payments are safer for both parts of a transaction:
  - **Lowered risk of theft** – carrying less cash may decrease the probability of theft (by 11% in the study for China[1]).
  - **Easier warranty claims** – payments history can be used to claim warranty, some credit cards offer extension of the warranty.
  - **Fraud reduction** – digital transactions facilitate record keeping and improve transparency by creating an electronic trail.
  - **Chargeback and alike mechanisms** – useful in cases such as business bankruptcy or identity theft.
- In addition to this, **digital payments also help reduce the cash shadow economy, thereby improving fair competition and resulting in an increased fiscal space for public spending.**

Cash shadow economy and lost CIT and sales tax/VAT revenues due to the cash shadow economy



Potential benefits of replacing cash with electronic payments

Based on estimates for 33 countries:

Cash shadow economy reduction due to replacing **10%** of the value of domestic cash consumer payments with electronic transactions

FROM 0.4% of GDP → TO 2.1% of GDP

Additional government revenues from sales tax/VAT and CIT due to replacing **10%** of the value of domestic cash consumer payments with electronic transactions

FROM 0.02% of GDP → TO 0.42% of GDP

Note: Calculations based on EY research for 33 countries (depending on the country, calculations performed for years 2014-2018)
Source: EY

[1] Jiang, H., Liang, P., & Ling, L. (2023). Mobile Payment Use and Crime Reduction. SSRN Electronic Journal.

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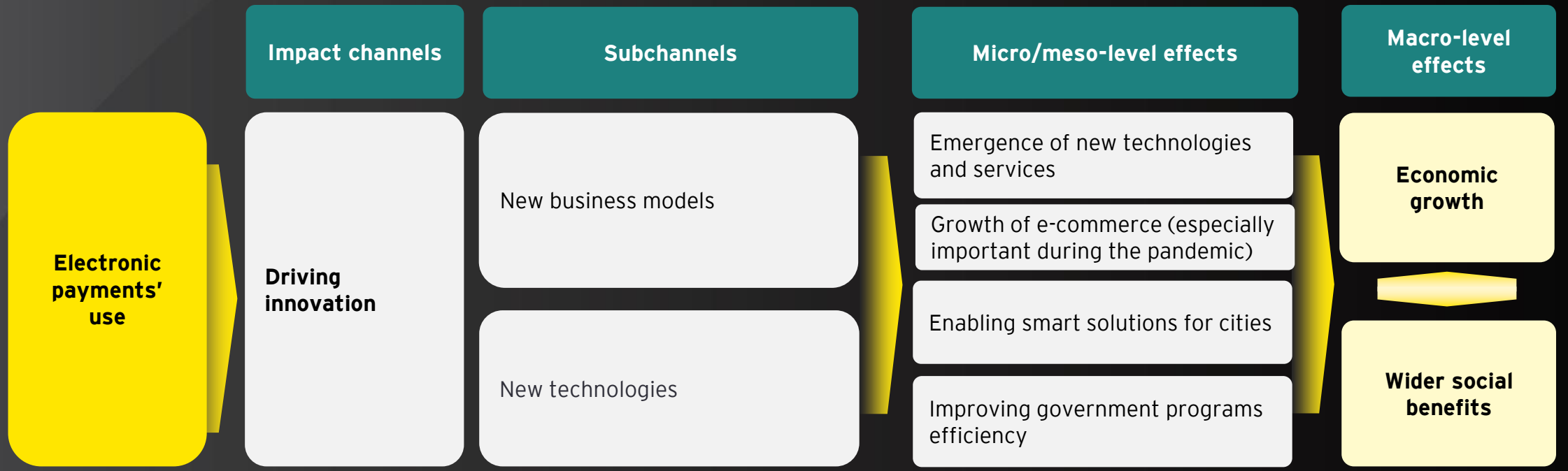
HOW ELECTRONIC PAYMENTS IMPACT THE ECONOMY AND SOCIETY?

2.2

Driving innovation

Electronic payments drive innovations that positively affect the economy and society

- The *Driving innovation* channel impacts the economy and society mostly due to new business models and technologies, whose development has been induced or strongly connected with electronic payments, resulting in:
  - Micro/meso-level effects – such as growth of e-commerce or enabling smart cities solutions
  - Macro-level effects – i.e. economic growth and wider social benefits



Source: EY

Innovations in the payments market transform traditional businesses and create new services

Effects	Examples
 Changes in the payment technology profoundly transform traditional businesses	Development of self-checkout stations in shops that are becoming increasingly popular in Europe[1] and AI-enhanced payment technologies with automated customer service, which improve customer experience and reduces costs.[2]
 Electronic payments constitute a vital part of mobile apps	Allowing users to conveniently order taxi/driver, delivery of food and effortless rental of several types of products, including cars (where instant access is granted using the mobile app), e-scooters or bikes.[3]
 New types of jobs and businesses could develop due to digital transactions	Independent creation of content online (e.g. blogs) is often financed using digital transactions (e.g. crowdfunding or automatic algorithms based on clicking ads).
 Cashless payments have transformed the banking system	New financial services such as online banking[4], Peer-to-Peer Payments, cryptocurrencies, and a reduction of the number of traditional brick-and-mortar bank branches.
 Electronic transactions play a crucial role in developing e-commerce which, among others, supported the economy during the COVID-19 pandemic	Vast majority of e-commerce payments are settled online, especially for cross-border trade. During the C-19 pandemic e-commerce supported transactions that would not have taken place otherwise (e.g. due to social distancing).

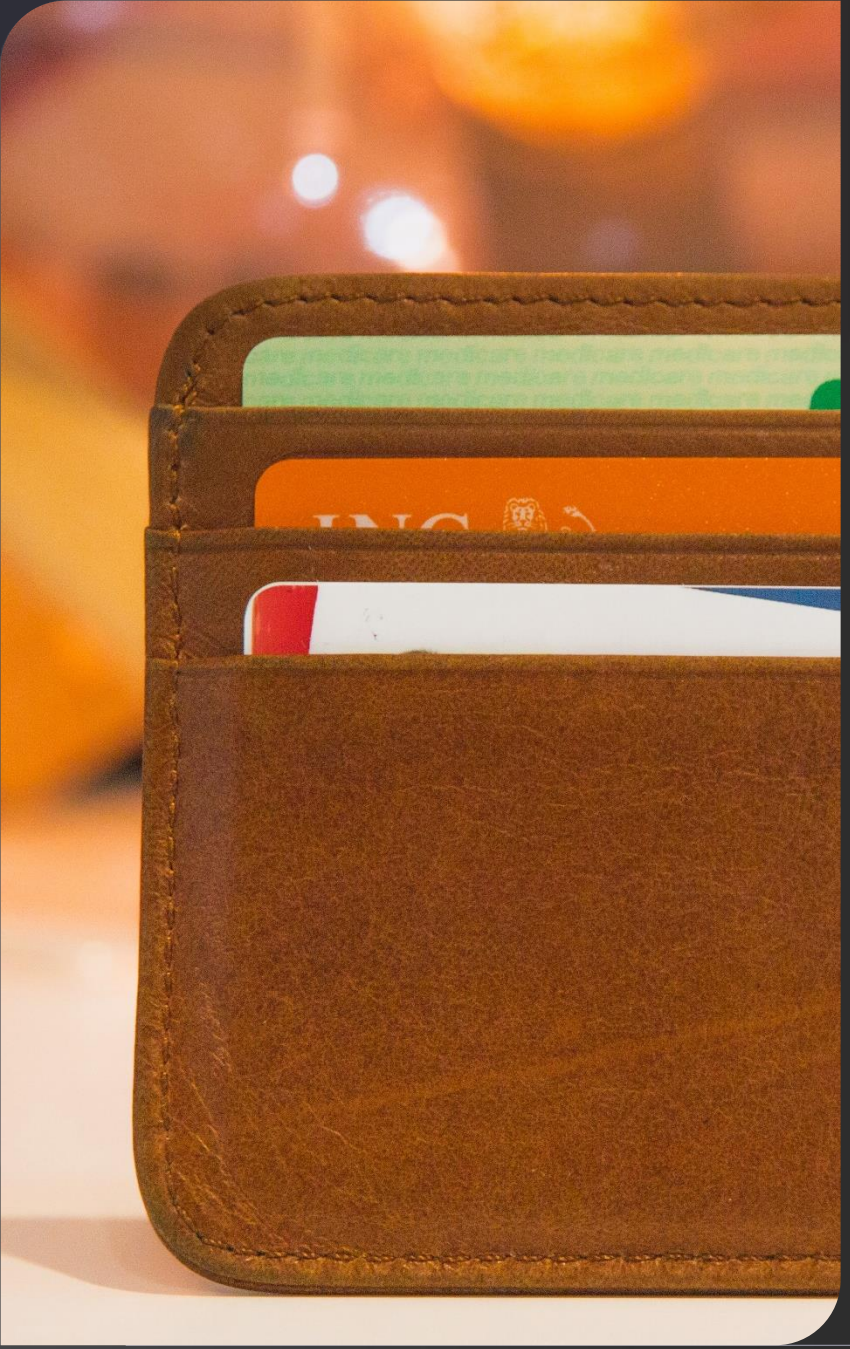
[1] https://www.ccv.eu/en/2021/consumers-take-the-lead-with-self-service [online, accessed 17.05.2024]
[2] https://monei.com/blog/ai-in-payments/ [online, accessed 10.07.2024]; [3] https://www. lieferando.de/; https://panekcs.pl/en/step-by-step; https://www.li.me/locations [online, all links accessed 17.05.2024]
[4] https://www.paymentoptions.com/the-evolution-of-digital-payments-a-cashless-revolution-2/ [online, accessed 17.05.2024]

Cashless payments enable development of various smart solutions

- **Payment cards often work as enablers in smart solutions**, such as smart cards in the public transport, smart parking app, enhancing the social support programs, developing smart identity cards or providing smart mobile apps for tourists based on advanced data analytics.

Smart solution	Examples	Potential benefits
Smart card/app in public transport Smart cards and other solutions (e.g. mobile apps) that enable purchasing public transport tickets (e.g. using a pre-paid account).	Amsterdam, London, Lisbon, Madrid	Increase in revenue: **3%-12%**[1] Increase in ridership: up to **17%**[2] Decrease in fare payment evasion: **0.9%-3.0%**[2]
Smart parking Solutions that focus on improvement of parking space availability or their utilization. Usually, smart parking apps require electronic payment of a parking fee.	Paris, Barcelona	Decrease in parking violations: **10%-55%**[3] Decrease in downtown traffic: **5-25%**[4] Reduction of parking costs: up to **50%**[5] Increase in availability of parking spots[5]
Smart social support solutions Solutions promoting electronic disbursement of social security support (e.g. via pre-paid cards) or supporting social organizations e.g. via cash-back transfers to social organizations.	Often coordinated at the state/national level, but also at the city level, e.g. Milan	Decrease in the number of crimes: **11%**[6] Decrease in the shadow economy Improved control over the flow of funds[7] Decrease in administrative costs
Smart identity card Cards or mobile apps that enable easy electronic identification of the citizen. Such solutions are usually developed at the national level. Such cards can also be used to settle payments.	Often coordinated at the national level, but some cities (e.g. Gijon in Spain) introduced local cards.	Increased access to cultural and sports facilities due to targeted promotions and discounts (approx. **7.5%** additional participants)[8]
Tourism analytics Tools focusing on data collection and analysis regarding the tourists in the city (e.g. used to identify tourism patterns, specific tourism problems such as overcrowded busses; long queues in museums etc.). Electronic payments can be used either as a potential data source (on aggregated, general level) or to provide incentives for tourists (e.g. offering various discount in less congested areas of the city).	Amsterdam, Porto	Increase in overall tourist satisfaction[9]

Source: EY. [1] http://www.dobrepraktyki.pl/index.php?p1=2&p2=4&art=41&s=2; https://transport.ec.europa.eu/system/files/2016-09/2011-smartcards-final-report.pdf
[2] http://etheses.whiterose.ac.uk/660/1/uk_bl_ethos_485744.pdf [3] https://www.passportinc.com/case-studies/parkboston-case-study/ [4] https://www.worldsensing.com/news/innovation-testing-fastprk2-eu-2/
[5] http://smartparking-systems.com/offer/smart-parking/ [6] Jiang, H., Liang, P., & Ling, L. (2023). Mobile Payment Use and Crime Reduction. SSRN Electronic Journal [7] Muralidharan, K., Niehaus, P., Sukhtankar, S. (2016), Building state capacity: Evidence from biometric smartcards in India, American Economic Review 106:10 (2016): 2895-2929 [8] EY elaboration on the basis of program summary data
[9] http://urbact.eu/sites/default/files/151_Gijon_Gpsummary.pdf [online, all links accessed 16.07.2024]



Electronic payments can improve government programs efficiency

- **Potential benefits** due to electronic disbursement of social security funds include:
  - **Potential reduction of crime.** For example, switching from delivering social cash transfers by paper checks (which needed to be cashed) to debit cards in 1990s in Missouri (US) led to a decrease in the overall crime rate by almost 10%.[1]
  - **Ensuring that funds provided by the government are spent according to their purpose.** For example, electronic payments can be used in programs funding specific needs, such as education, where such a form of payment can also be used to establish that the money was spent on education and not for other purposes.
  - **Speeding up the process of receiving funds and facilitating reaching the beneficiaries.** For example, the expansion of electronic payment options in Italy has simplified tax and utility bill payments for millions of Italians, improving the efficiency of tax and bill collections and offering greater convenience for residents.[2]
  - **Lowering costs of intermediaries and administration costs.** The National Audit Office (NAO) in the UK has estimated that using cards typically saves around 35% in transaction costs or £5 per transaction compared with traditional methods.[3]
- **Electronic disbursement of wages and salaries can also have substantial social benefits.**
  - For example, United Arab Emirates implemented the Wages Protection System, where wages are paid electronically to accounts held at approved financial institutions, which are monitored by the Ministry of Labour.[4] The main aim of the policy was to ensure that wages are paid on time and at full value.

[1] Wright, R., Tekin, E., Topalli, V., McClellan, Ch., Dickinson, T., Rosenfeld, R., (2014). Less cash, less crime: evidence from the electronic benefit transfer program. NBER Working Paper 19996. The reduction of crime level was mostly related to reduction in property crimes. [2] https://ec.europa.eu/futurium/en/content/electronic-payments-enabler-egovernment.html [online; accessed: 20.05.2024] [3] https://www.nao.org.uk/reports/the-government-procurement-card/ [online, accessed: 11:07.2024] [4] http://www.ilo.org/dyn/migpractice/migmain.showPractice?p_lang=en&p_practice_id=186 [online, accessed 20.05.2024]

2

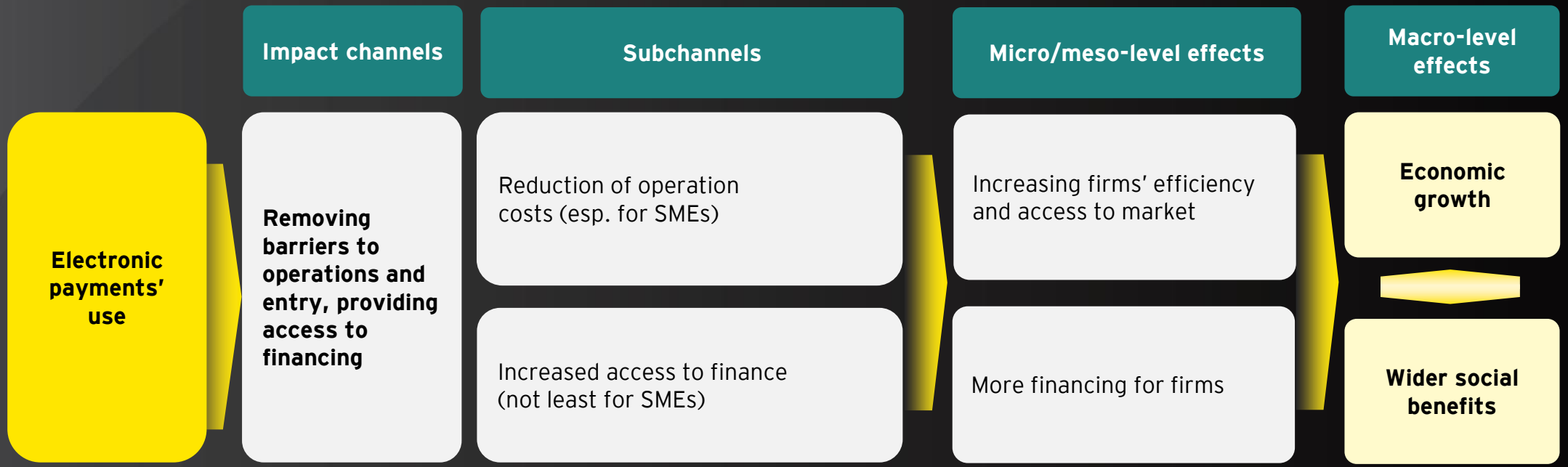
HOW ELECTRONIC PAYMENTS IMPACT THE ECONOMY AND SOCIETY?

2.3

Removing barriers to operations and entry, providing access to financing

Electronic payments remove barriers to operations and entry and provide access to financing for firms

- The *Removing barriers to operations and entry, providing access to financing* channel impacts the economy and society mostly through reducing operation costs and increasing access to finance, which results in:
  - Micro/meso-level effects – such as increasing firms' efficiency, their access to market and expanding their funding options
  - Macro-level effects – i.e. economic growth and wider social benefits



Source: EY

Cashless payments can increase firms' efficiency and improve access to market

- **Important benefits of electronic payments development comprise reduced operating costs and improved access to new sources of capital for companies.** This way, cashless payments support development of businesses, help remove barriers to entry for new firms and stimulate economic activity.
- **Digital transactions are helpful in case of vendor disputes**, because transactions performed with cash can later be undermined if there is not enough evidence that the payment in fact occurred.[1]
- **Cashless operations reduce the risk of theft**, which is a risk affecting especially small businesses.[2]
- **Inventory management is easier with digital payments** especially if a company cannot afford expensive systems for integrating all areas of operations.
- **Lowered barriers to entry** for the entrepreneurs attempting to operate as an e-commerce entity compared to starting a traditional business.[3]

[1] Klapper, L. (2017), How digital payments can benefit entrepreneurs. IZA World of Labor 2017: 396.
[2] https://abbeysecurity.co.uk/cost-crime-small-businesses/ [online; accessed: 22.05.2024]
[3] https://one.oecd.org/document/DAF/COMP/WD(2018)73/en/pdf [online; accessed: 22.05.2024]

Electronic payments can enhance access to financing

- **Cash conversion cycle (CCC) is significantly lower for firms with high adoption of cashless payments.** For example, for non-financial firms in India in 2017 the mean CCC for firms with high adoption of electronic cashless payments equalled 53.94 days, compared to 101.84 and 108.22 days for the medium and low adoption level firms, respectively.[1] Receiving payments on time lowers the amount of capital needed to operate, which is especially valuable to small businesses.
- **Electronic payments make funding of small businesses easier through a number of channels.** They:
  - **Enrich firm's credit file** and improve their credit score, hence lead to an increase in their chance of getting funded.[2]
  - **Enable financing of firms on lending and crowdfunding platforms.**[3]
  - **Stimulate general financial inclusion resulting in more enterprises being clients of financial institutions.** This leads to firms' higher use of various financial services, such as credit or insurance, which support the running and expansion of business. At the macroeconomic level, there is much evidence that financial development (incl. credit expansion) may stimulate the economic growth.[4]

[1] Mahadevan, B. (2019). Reduce working capital and increase profitability: Using electronic payments. Journal of Banking and Financial Technology, 3(1), 83-95.
[2] https://blogs.worldbank.org/psd/how-can-alternative-data-help-micro-small-and-medium-enterprises-msmes-access-credit-0 [online; accessed: 27.07.2021]
[3] Klapper, L., How digital payments can benefit entrepreneurs. IZA World of Labor 2017: 396 doi: 10.15185/izawol.396.
[4] Levine, R. (2005). Finance and Growth: Theory and Evidence, Handbook of Economic Growth, in: Philippe Aghion & Steven Durlauf (ed.),Handbook of Economic Growth, edition 1, volume 1, chapter 12, pages 865-934, Elsevier.

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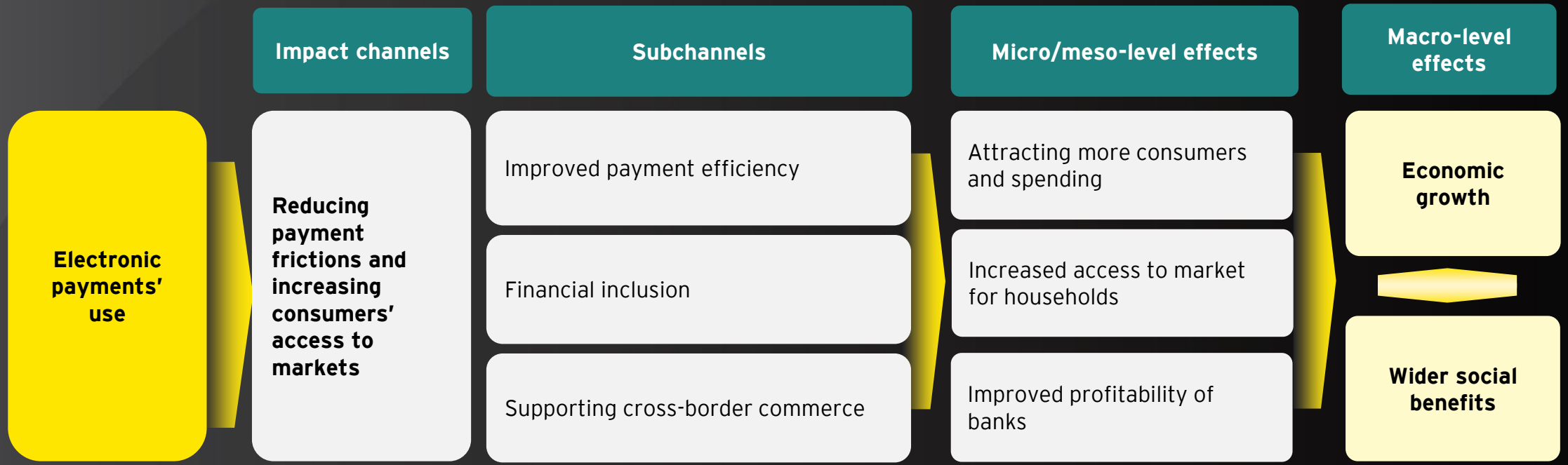
HOW ELECTRONIC PAYMENTS IMPACT THE ECONOMY AND SOCIETY?

2.4

Reducing payment frictions and increasing consumers' access to markets

Electronic payments reduce payment frictions and increase consumers' access to markets

- **Digital payments significantly improve payment efficiency, promote financial inclusion and support cross-border commerce.** With the development of technology, cashless payments run more and more smoothly. As a result, they can require less time than cash operations, offer new opportunities and allow access to finance, especially for disadvantaged groups. The results are visible on two levels:
  - **Micro/meso-level effects** – such as increased access to market for households or attracting more consumers and spending
  - **Macro-level effects** – i.e. economic growth and wider social benefits



Source: EY

Digital payments attract more consumers and spending

- **Modern types of electronic payments are significantly faster than cash transactions.** Although the old types of cards required more time than cash payments, technological progress has made card payments (especially contactless) faster than cash. For example, Mastercard investigated that PayPass transactions were 6 to 10 seconds faster than other payment methods available in stores[1], and other study[2] shows that contactless payments can take as little as 0.5 seconds to complete.
- **Transaction speed is essential to customers.** It is one of the most critical factors to determine the choice of a payment method[3] as shorter payment time reduces lines and consumers' payment costs. For example, 34% of respondents in Germany declared that speed is an important benefit of cashless payments.[4]
- **The efficiency gain for customers can be even larger in the case of high-value transactions** as, if conducted in cash, they require multiple banknotes to be counted and checked for authenticity. This process takes time for the customer and requires other resources (e.g. purchase of machines used for counting or authenticating bills), which could be located elsewhere.

1 Sarlak, M. A. (Ed.). (2010). E-Banking and Emerging Multidisciplinary Processes: Social, Economical and Organizational Models: Social, Economical and Organizational Models. IGI Global.
2 https://www.visa.ca/dam/VCOM/regional/na/canada/merchants/documents/visa-paywave-put-your-customer-in-the-fast-lane-en.pdf [online, accessed 29.07.2021]
3 Klee, E. (2006), Paper or Plastic? The effect of time on check and debit card use at grocery stores, Working Paper, Board of Governors of the Federal Reserve System.
4 Deutsche Bundesbank. (2022). Payment behaviour in Germany in 2021. Retrieved from: https://www.bundesbank.de/resource/blob/894118/6c67bcce826d5ab16a837bbea31a1aa9/mL/zahlungsverhalten-in-deutschland-2021-data.pdf [online, accessed 13.05.2024]

Digital payments attract more consumers and spending

- **In the case of cash, consumers are limited to the funds they have with them**, while merchants may be unwilling to offer credit for larger amounts due to the risk of non-payment. **Electronic payments**:
  - **provide consumers with access to all available funds** (or lines of credit) for a given transaction,
  - **provide merchants with a sense of confidence about the payment** granted by appropriate procedures.
- **Cashless payments' systems are an essential driver for cross-border online trade.**[1] As a result, consumers have access to a more diverse choice of goods and services from all over the world.
- **Digital payments are connected with spending related to travel and tourism.**[2] Cashless payments are more convenient for international travelers compared to cash. Electronic payments provide money exchange services (e.g. via payment cards) and easy payment options that eliminate the need to carry large amounts of cash, which also reduces the risk of theft.

1 Gomez-Herrera, E., Martens, B., Turlea, G. (2014), The drivers and impediments for cross-border e-commerce in the EU, Information Economics and Policy, 28, 83-96.

2 Bayona, L., Vanesa, L., Ruiz-Rua, A. (2019). The importance of online payment on Travel and Tourism incomes - A Cross-Country Panel Data Study. Academicus. International Scientific Journal, 20, 191-214.

Cashless transactions increase access to market for households

- **Electronic payments via e-commerce are valuable for consumers in remote areas**, where access to offline outlets is limited. They gain an increased access to market and achieve significant savings in search costs.[1]
- **E-commerce may lower retail prices** due to higher competition in the online channel and potential cost savings. Consumers expect online prices to be lower than offline.[2] There are studies showing such pattern. For instance, around 2015, multi-channel retailers in Germany sold the same products online for an average of 2% less than offline. Looking only at the products with price disparities, an average price reduction in the online channel amounted to 8%.[3]
- **Digital payments contribute to a better access to finance for households and higher use of financial services.** Cashless transactions serve as a gateway for a broader range of financial products, including credit and insurance. They, in turn, allow individuals to start and expand business, invest in education or health, manage risk, and weather financial shocks. Card payment data can also impact access to finance directly – for example, enabling consumers to leverage their positive payment information for utilities, telecoms and streaming services from their checking or credit card accounts can improve their creditworthiness and even make credit scoring possible for more consumers.[4]

1 The World Bank and Alibaba group Report (2019),

2 Jensen, T., Kees, J., Burton, S., & Turnipseed, F. L. (2003). Advertised reference prices in an internet environment: effects on consumer price perceptions and channel search intentions. Journal of Interactive Marketing, 17(2), 20-33.

3 Strasser, Georg et al. (2023), E-commerce and price setting: Evidence from Europe, ECB Occasional Paper, No. 320, ISBN 978-92-899-6149-3, European Central Bank (ECB), Frankfurt a. M., https://doi.org/10.2866/024278 [accessed: 13.08.2024]

4 https://www.experian.com/blogs/ask-experian/experian-boost-study/ [online, accessed: 29.05.2024]

Electronic payments improve profitability of banks

- Banks play a crucial role in the development and provision of electronic payments, but **cashless transactions can also have a profound impact on the situation of banks.**
- **Fees on electronic transactions generate profits for banks directly**. In addition, the use of such payments **allows banks to profitably cross-sell their products or create new services.** Moreover, credit card payments history can be used to generate credit scoring and better evaluate the credit risk. Banking profits, if retained in companies, **increase their capital** and:
  - **Support bank lending that stimulates the economic growth as additional financing is used by (1) firms to fund investments in productive capital and technology,** which improves firms' productive capacity and efficiency, as well as by (2) individuals who can finance additional consumption expenditure. For example, Acharya et al. (2020) find that a 1pp increase of regulatory capital requirements is associated with a 1.7pp decrease in the amount of lending in banks from the euro area. Since retained fees on electronic transactions increase banks' capital, they can support lending and related economic effects.
  - **Reduce the risk of bank failure[3], improving the financial stability** in the country and ensuring a continuous supply of credit.

[1] Aiyar S., Calomiris C.W., Wieladek T. (2012), Does macro-prudential regulation leak? Evidence from a UK policy experiment, NBER Working Paper, 17822. The above metioned effect disappears for banks with excess capital to total assets ratios of around 6 percent or higher.

[2] Awwad, B. S. (2021). The role of e-payments in enhancing financial performance: A case study of the Bank of Palestine. Banks and Bank Systems, 16(4), 114-124

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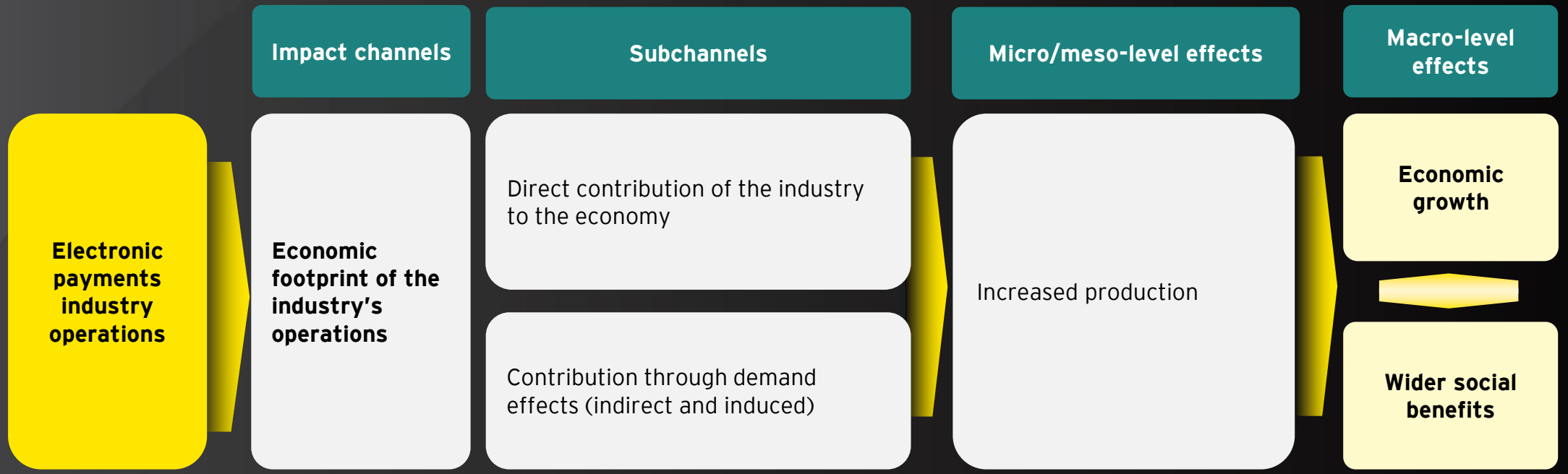
HOW ELECTRONIC PAYMENTS IMPACT THE ECONOMY AND SOCIETY?

2.5

Economic footprint of the electronic payments industry's operations

Economic footprint of the electronic payments industry's operations

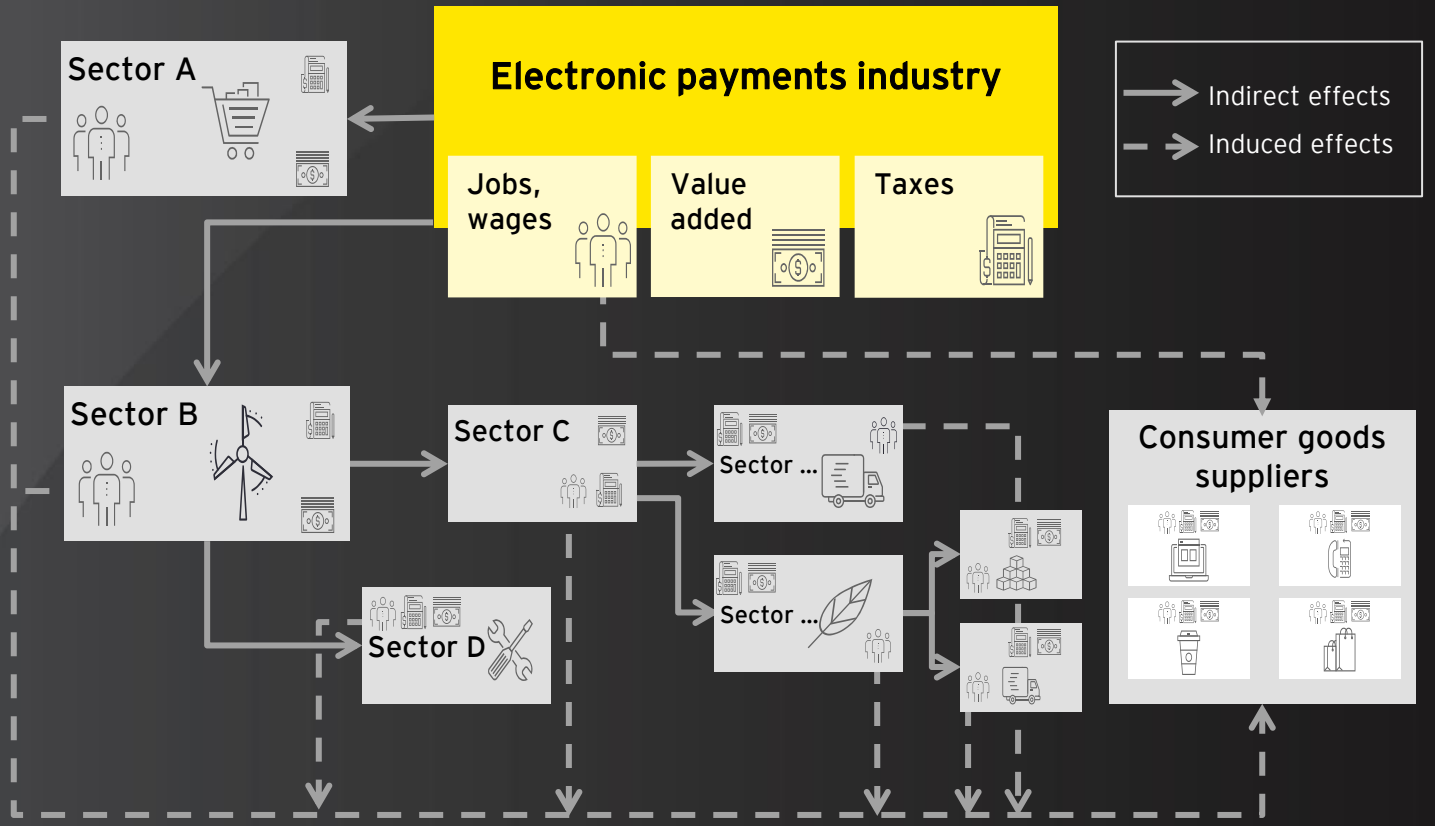
- Apart from the discussed various **transformative impacts of electronic payments' USE** on the German economy and society, **there is also an impact related to the electronic payments industry OPERATIONS** , including not only the value of goods and services produced, jobs generated or taxes paid by the industry itself, but also the impact on the industry's supply chain and their employees – economic effects generated through this channel are much smaller than those resulting from electronic payments use and are not calculated in this study.[1]



Source: EY [1] Economic impact of electronic payments industry operations can be estimated with an input-output model and the industry's data. EY estimated such effects, e.g., in a similar study for the US economy.

Electronic payments industry impacts the economy not only directly but also through the so-called demand effects

Illustration of economic effects of the electronic payments industry



Source: EY

DIRECT EFFECTS
stem from the electronic payments industry's own production, employment, taxes paid etc.

INDIRECT EFFECTS
result from the demand of the electronic payments industry for products and services of various companies in the industry's supply chain

INDUCED EFFECTS
are generated by consumer spending of employees whose employment results from direct and indirect effects of the electronic payments industry's activity

2

HOW ELECTRONIC PAYMENTS IMPACT THE ECONOMY AND SOCIETY?

2.6

Wider social benefits

Electronic payments can yield social benefits through economic effects (e.g. allowing higher government spending) and more directly

Reducing inequalities and poverty, reaching underserved populations

There are several factors that allow electronic payments to reduce inequalities and poverty. They include **increasing access to markets for people in remote areas and lowering retail prices** (via e-commerce and related increased competition), **creation of new jobs and increased availability of financial services for households**[1]. Electronic payments also **increase security of transactions**. All these effects may be particularly **relevant for various underserved populations.**

Reducing environmental (e.g. carbon) footprint

Existing studies indicate that **digital payments can have a lower environmental footprint than cash payments.** For example, studies conducted in the Netherlands show that global warming potential (GWP) for an average cash transaction in the Netherlands was over 20% higher than GWP of a debit card payment[2]. Cards' environmental impact depends on the energy mix in a country, so it may be lowered by using more energy from renewable sources.

Reducing health risks (e.g. during the COVID-19 pandemic)

Cashless transactions **allow people to order online necessary items during a quarantine or lock-down.** Online purchases also **allow vulnerable people to spend more time at home** without exposing themselves to the contagion risk. In addition, contactless payments **can be used to increase the distance between the seller and buyer** and thus decrease the risk of contagion.

1 See, for example: Fan, J., Tang, L., Zhu, W., & Zou, B. (2018). The alibaba effect: Spatial consumption inequality and the welfare gains from e-commerce. Journal of International Economics, 114, 203-220; The World Bank and Alibaba group Report (2019), E-commerce development: Experience from China and Ozili, P. K. (2018). Impact of digital finance on financial inclusion and stability. Borsa Istanbul Review, 18(4), 329-340.

2 Lindgreen, E.R., van Schendel, M., Jonker, N., Kloek, J., de Graaff, L. and Davidson, M. (2018), "Evaluating the environmental impact of debit card payments.", Int J Life Cycle Assess 23, 1847–1861 and Hanegraaf, R., Jonker, N., Mandley, S. and Miedema, J. (2018), "Life Cycle Assessment of Cash Payments.", De Nederlandsche Bank Working Paper No. 610

Cashless transactions can also create some challenges

- **Easy access to external financing from credit cards might lead to overindebtedness of some households.** This can even affect the stability of the financial system. The solution is consumer education on the financial risks and sound macroprudential policy.
- **Assuring the security of personal information, as cases of identity thefts or unauthorized access to payment data can have severe personal consequences.** To address this:
  - Countries introduce legislations that account for the importance of personal data and offer protection of victims of data-related crimes
  - Banks and payment system providers invest in cybersecurity and protection mechanisms for victims of frauds.
- While electronic payments support the growth of e-commerce that has many, already discussed, benefits, the development of online commerce also generates some risks. **In many Internet-related markets only small number of businesses have emerged as globally dominant**[1], which can result in some negative socioeconomic effects as high prices (monopoly rent), limited supply and reduced incentives to innovate[1].
- **A hypothetical total eradication of the cash seems risky as there are cases when cashless payments are not available.** For example, after extreme occurrences, such as hurricanes, the temporary lack of electricity or the Internet the use electronic payments may not be possible.

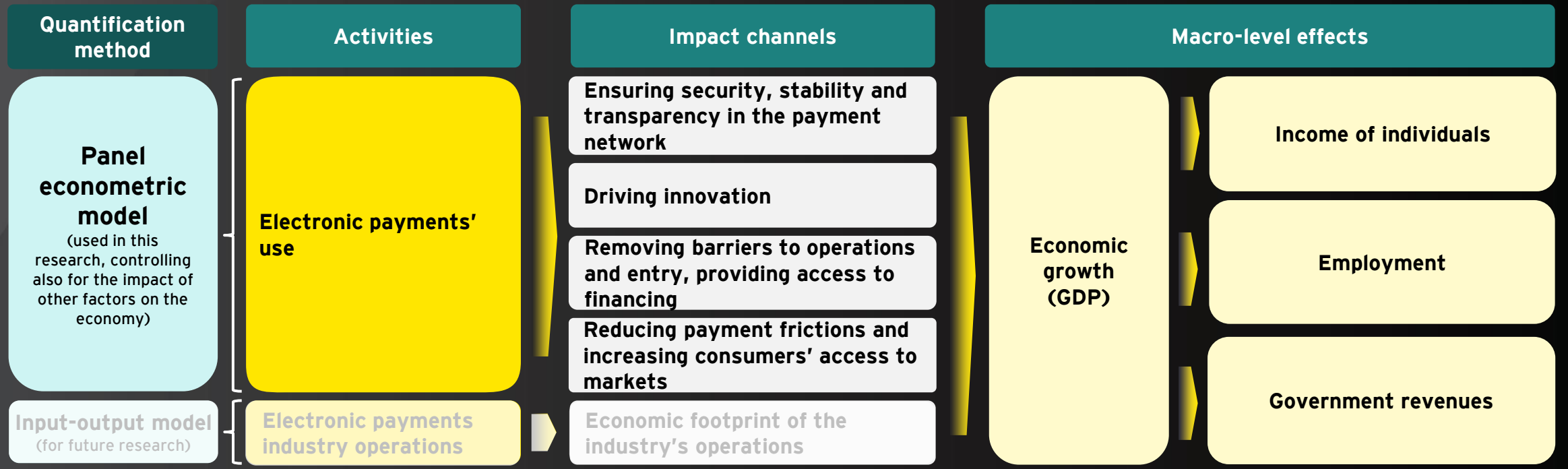
[1] McCarthy, P. X., Gong, X., Eghbal, S., Falster, D. S., & Rizoiu, M.-A. (2021). Evolution of diversity and dominance of companies in online activity. PLoS ONE, 16(4), e0249993

3

QUANTIFYING THE IMPACT OF ELECTRONIC PAYMENTS' USE ON THE GERMAN ECONOMY

We quantify the impacts of electronic payments' use with econometric modelling

- While analysing the effects related to digital payments in Germany, **we focus on the impact of card payments' use**,[1] which is quantified with a panel econometric model.[2]
- We **concentrate on card payments** (instead of other types of electronic transactions), since there is relatively much data available for them and due to the fact that card payments play a principal role in the overall electronic payments market, especially for consumers.



Source: EY

[1] In this study "card payments" stand for all payment transactions initiated with a card-based payment instrument at a terminal or via other channels (incl. payments: at POS and online, with plastic card and contactless/NFC, digital wallet, etc.).

[2] More details on the applied methodology, calculations and data are included in technical appendices to the study.

3

QUANTIFYING THE IMPACT OF ELECTRONIC PAYMENTS' USE ON THE GERMAN ECONOMY

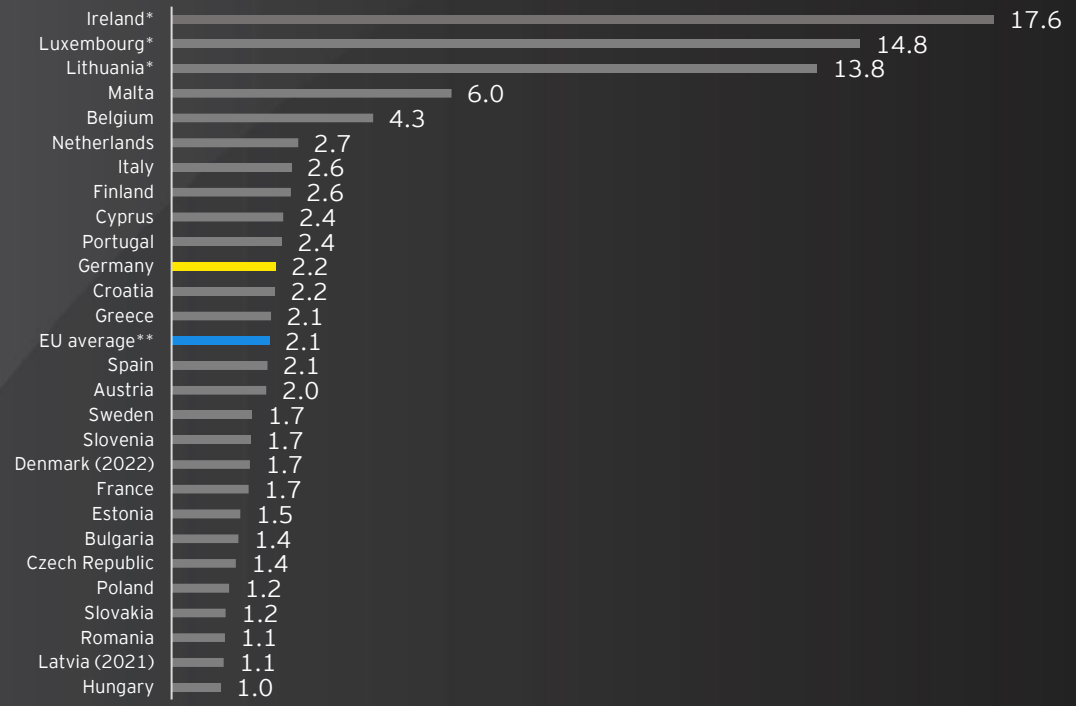
3.1

Overview of electronic payments' development in Germany

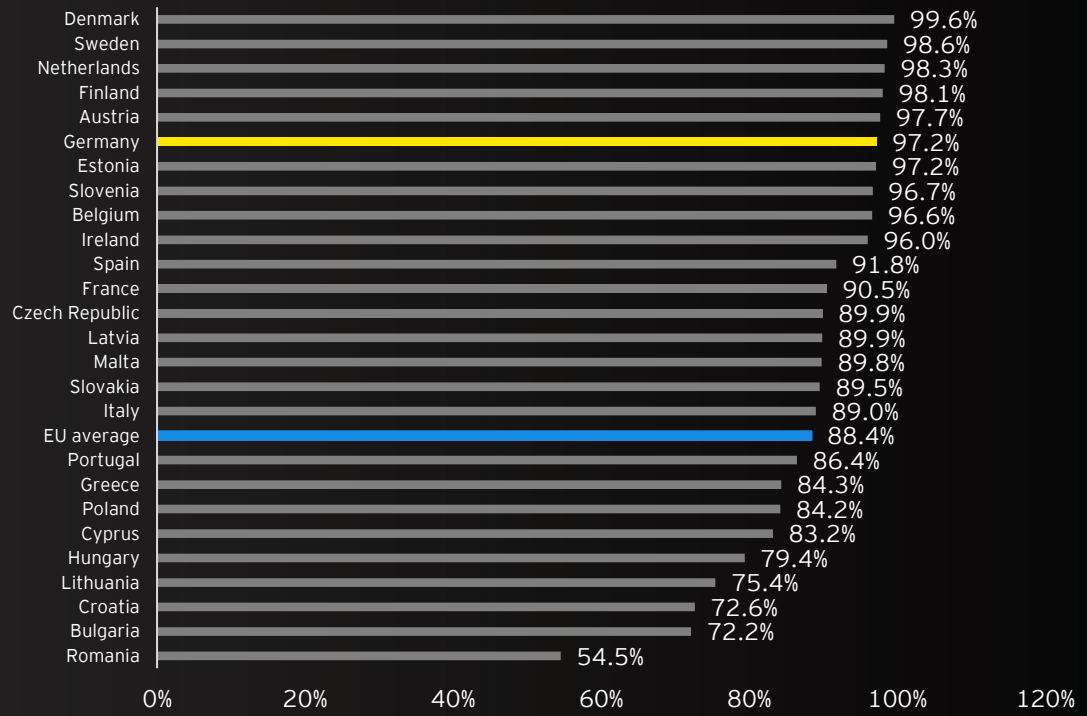
Germany ranks above the average in the EU regarding the issued cards and, especially, their ownership in the population

- The number of cards issued per capita in Germany (2.2 in 2023) was slightly above the EU average (2.1), excluding outliers[1].
- In Germany in 2021, over 97% of respondents aged 15+ had a debit or credit card.

Number of cards issued by resident PSPs[2] per capita in 2023



Debit or credit card ownership[3] in 2021 [as % of aged 15+]



[1] We focus on comparison with EU countries due to good availability of comparable data for them from the European Central Bank. For some top countries on the first chart (marked with *) figures are likely distorted. One can observe a notable increase in the number of cards issued in Lithuania since 2020. This is a consequence of Brexit when several payment and electronic money institutions in the United Kingdom have shifted their activities to Lithuania. The high values in Ireland and Luxembourg may be due to tax benefits related to registering some operations of Payment System Providers in these countries or some incentives to have multiple payment cards.
[2] PSP = Payment System Providers; ** EU average excluding three top outliers.
[3] For Luxembourg no data was available. EU average does not include this country.

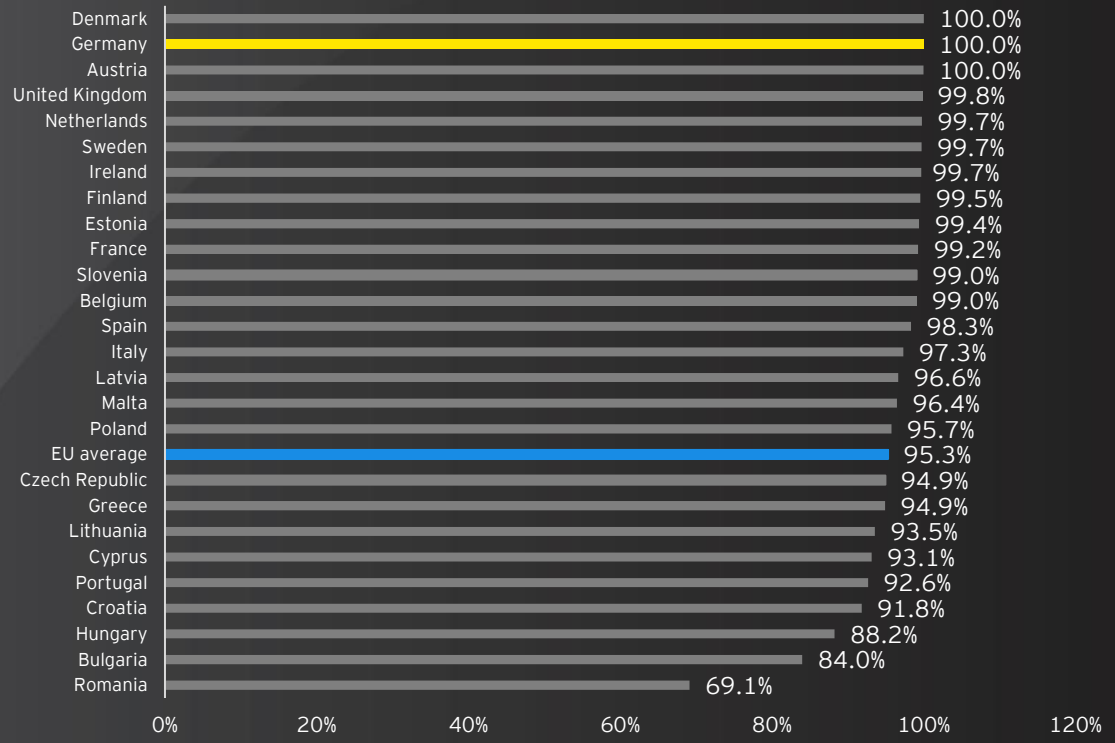
Source: EY calculations based on ECB and Eurostat data

Source: World Bank, Global Findex Database

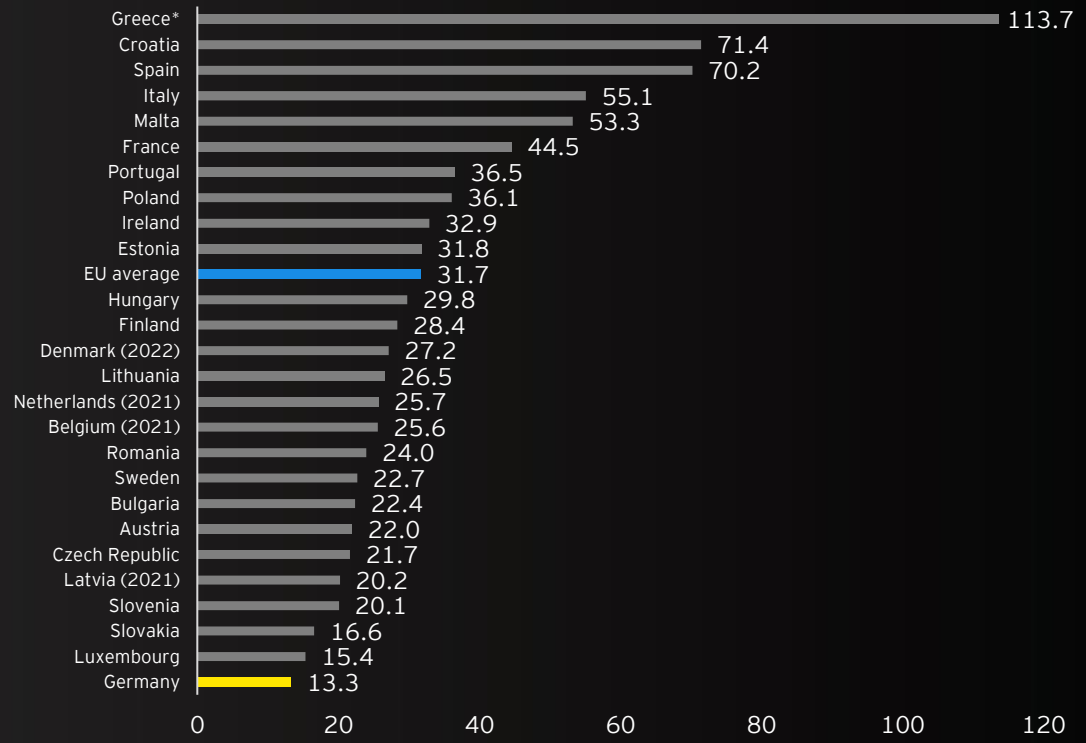
(Almost) all Germans have bank accounts. Yet, there is likely a large room for additional POS terminals in the country

- In Germany, the **bank account ownership rate** (99.98% in 2021) **is very close to the maximum**.
- However, the **number of POS terminals per 1000 people in Germany** (13.3 in 2023) **is the lowest in the EU**.

Bank account ownership[1] in 2021 [as % of aged 15+]



Number of POS terminals[2] per 1000 people in 2023



[1] For Luxembourg no data was available. The EU average for bank account ownership (as a % of aged 15+) does not include this country.
[2] Outlying value for Greece (marked with *) may be explained by restrictions on cash withdrawals which resulted from economic crisis, tourism, and the government's active promotion of electronic payments, including the organization of lotteries. For Cyprus no data was available. The presented EU average does not include Greece and Cyprus.

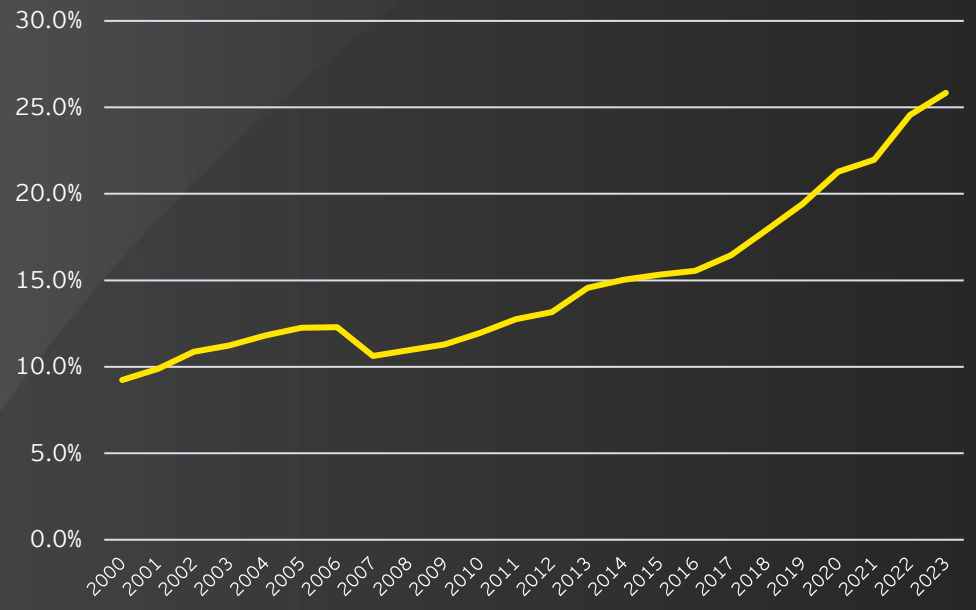
Source: World Bank, Global Findex Database.

Source: EY calculations based on ECB and Eurostat data

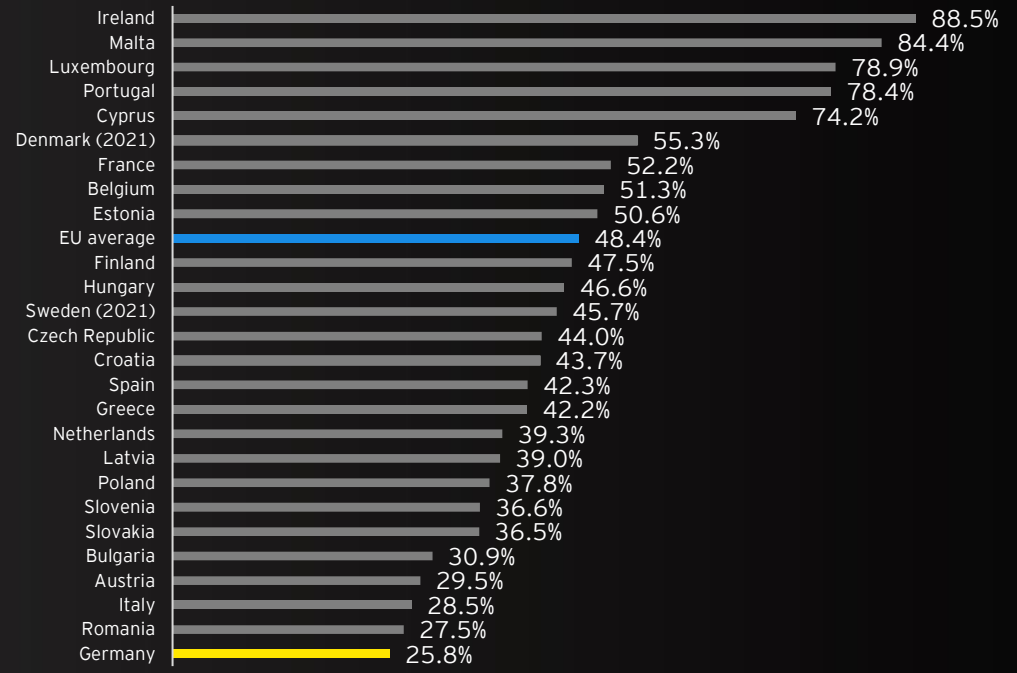
Despite improvement, the role of card payments in household consumption in Germany is among the lowest in the EU countries

- We define card penetration ratio = value of card payments/households final consumption expenditure.
- **Despite a significant increase since 2018, Germany's card penetration ratio in 2023 (25.8%) was the lowest among EU countries, suggesting a room for further growth.**

Card penetration ratio as % of HFCE, Germany, issuing side (payer's PSP)[1]



Card penetration ratio as % of HFCE in 2023, issuing side (payer's PSP)[1]



Note: HFCE = Households final consumption expenditure. It also includes some non-monetary categories, e.g. imputed rents. Apart from cash, some HFCE can also be settled with other electronic payments such as wire transfer. Card payments may also include business expenditure but for most countries they constitute a minor part of the total card payments value.
[1] The data was calculated from the issuing side, i.e. it includes value of card payments with cards issued by resident payment system providers (PSP) at merchants in a given country and abroad. Lithuania was excluded as an outlier on the right-hand chart and the EU average there does not include this country.

Source: EY calculations based on ECB (card payments) and Eurostat data (households final consumption expenditure).

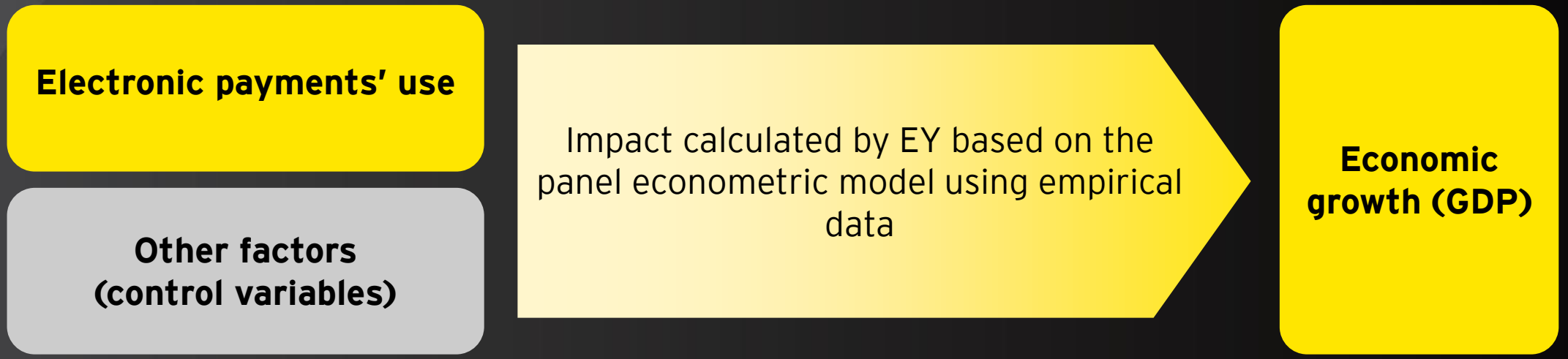
3

QUANTIFYING THE IMPACT OF ELECTRONIC PAYMENTS' USE ON THE GERMAN ECONOMY

3.2
Impact of electronic payments' use on the German economy

We estimate the impact of electronic payments' use on the German economy with an econometric model

- Central role in this analysis is played by **an econometric model**. It is a statistical tool that, basing on empirical data, allows us to **estimate the average impact of the card penetration ratio on GDP**, while controlling for other factors that affect the country's economic performance. The covered factors include **the stock of capital assets, the state of the business cycle, government effectiveness index and the overall level of financial development**.
- **Our estimation dataset** includes information from the OECD countries and EU member states. In total, there are **36 countries in our model, observed over the 2000-2019[1] sample period**.
- **Combining the estimated relationship between card penetration ratio and GDP with card transactions value in Germany in 2023**, we calculate the impact of electronic (card) payments' use on GDP in Germany in 2023.
- Estimated effects on the economic growth (GDP) were translated into effects for employment, individual income and tax revenues using the average ratios between GDP and these variables in the analysed country.



[1] The analysis has not been extended beyond these years for two reasons. Firstly, the years 2020-2021 were highly atypical due to the COVID-19 pandemic, which disrupted the relationships between various economic factors and resulted in less reliable statistical data. Secondly, currently available data extends only up to 2022, and the inclusion of a few years of additional data should not significantly impact the estimation results.

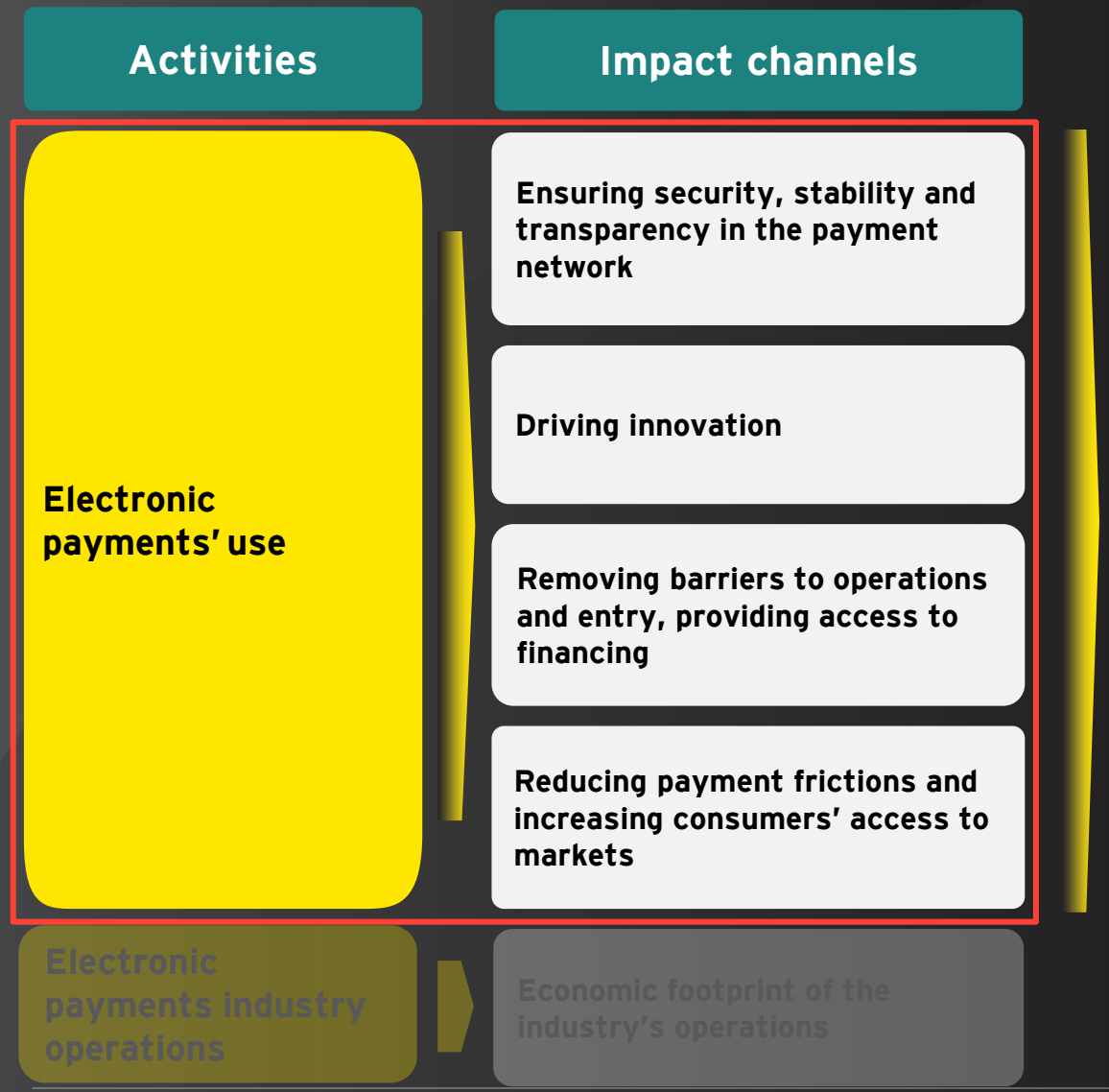
We selected the baseline econometric model that had the best statistical properties and produced the most reliable results

- Our model aims at solving **the problem of aggregation of the impact of electronic payments' use** via various channels, because it summarizes all those impacts in the form of a single coefficient.
  - An approach in which all the individual channels are quantified and then aggregated would be infeasible, because some effects are difficult to identify while many others may be overlapping and are not additive.
- Another issue in the impact assessment of electronic payments on economic growth is the **chicken-and-egg problem**. In this case, the problem is that economic development can also stimulate electronic payments. We use statistical techniques (**the generalized method of moments – GMM**) that help us produce a one-way result that may be interpreted in more causal terms.
- We considered many potential econometric models and carried out robustness checks to select the **baseline model that has the best statistical properties and produces the most reliable results**.[1]
- The obtained coefficient represents the aggregate, multichannel impact of electronic/card payments. Due to the high correlations among various forms of electronic payments, e-commerce, and related activities, it is difficult to distinguish their individual contributions. Since every econometric analysis based on observational data is subject to uncertainty, these **estimates should be interpreted with caution and regarded as indicative of the scale of impact**.

Key econometric result:
an increase in the card penetration ratio by 10pp increases GDP per capita by 1.2%, with all other factors unchanged

[1] See technical appendices to this study.

Electronic payments' use contributed in Germany to EUR 127bn of GDP, EUR 934 of individual annual income, 1.3m jobs and EUR 52bn of tax revenues in 2023



Impact of electronic payments' use on the German economy in 2023:

GDP
EUR 127bn

Individual annual income
EUR 934

Employment
1.3m jobs

Tax revenues[1]
EUR 52bn

correspond to

Share of the domestic economic activity[2]
3.1%

The figures represent the aggregate, multichannel impact of electronic/card payments. Due to the high correlations among popularity of various forms of electronic payments, e-commerce, and related activities, it is difficult to distinguish their individual contributions. Since every econometric analysis based on observational data is subject to uncertainty, especially in terms of causality, these estimates should be interpreted with caution, as indicative of the scale of impact.

Source: EY calculations.

[1] Tax revenues refers to the total tax and social contribution receipts; due to the lack of 2023 data we assumed the same share of taxes in GDP in 2023 as in 2022. [2] Our econometric analysis showed that electronic payments generated about 3.1% of GDP in 2023 in Germany. Estimated effects on GDP were translated into effects for employment, individual income and tax revenues using the average ratios between GDP and these variables in the analysed country. In such approach the shares of such effects in totals for the whole economy are the same (3.1%),

The economic impact of electronic payments' use may be summarized in the form of multipliers

- Despite the significant growth of card and other electronic payments in Germany since 2018, their use **remains lower than in most EU countries**, indicating **potential for further improvement** and additional positive socioeconomic effects.

1% increase in the value of electronic payments' use[2]

Increase in the German economic activity:[1]

GDP	Individual annual income
EUR 1.3bn	EUR 9.5
Employment	**Tax revenues**
13.5k	EUR 0.5bn

Source: EY calculations.

[1] Annual values (annual average for employment), values in EUR are presented in 2023 prices. See also footnotes on the previous page.

[2] 1% increase in the value of electronic (card) payments relative to the total value of households' consumption. Under certain assumptions, the results are scalable – e.g., to determine the impact of a 10% change, multiply the figures above by 10.

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