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The Reset Condition: Why Offline Card Payments Complement Cash Rather Than Replace It

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Abstract

European card schemes are extending offline authorization across the continent, and the measure is being presented as a response to power and network failure. This note examines what offline card payments can and cannot do when infrastructure fails, using only public primary sources: the memorandum underpinning the Swedish offline agreement coordinated by Sveriges Riksbank, the Banco de España analysis of the Iberian blackout of 28 April 2025, and the Eurosystem documentation on the offline digital euro. Three instruments are distinguished by what they settle and when: deferred authorization against issuer credit, pre-funded local settlement, and bearer settlement. Offline card capacity is shown to be bounded by four verified margins. It is a quantity stored on the chip that replenishes only on return to connectivity, a condition here termed the reset condition; it is delimited by merchant category; it is conditional on the cardholder's eligibility for credit; and it does not circulate, since the accepting merchant cannot spend what has been received. A fifth property follows analytically: because offline limits reflect issuer risk appetite and merchant acceptance remains voluntary, privately provided resilience contracts as a disruption lengthens. The note sets out the falsifiable conditions under which offline card payments would substitute for cash, none of which currently holds, and concludes that the two monetary authorities that have done most to extend offline functionality continue to recommend household cash holdings. The policy risk lies not in the technology but in the substitution inference being drawn from it in the legislative debate.

Key Highlights

- Offline card payments are a real improvement in payment resilience, but they complement cash rather than replace it.
- Offline capacity is a finite amount written on the card's chip, and it is restored only when the connection that failed comes back. This is the reset condition.
- Offline payments depend on credit standing and on the type of shop. In Sweden, cardholders who are not granted overdrafts, including most under-18s, are left out, and coverage is defined for food, pharmacy and fuel.

- During the Iberian blackout of 28 April 2025, card payments fell by about 55%. Offline authorization helped mainly where shops already had their own electricity.
- The Riksbank and the Banco de España, the authorities that have done most to extend offline card payments, continue to recommend that households keep cash.

1. Introduction

In October 2026 Mastercard announced that offline payment capability would be required across its European network, with newly issued cards enabled from February 2027 and new or replacement terminals required to support the function from May 2027 (Mastercard, 2026). The announcement is framed around continuity of payment when power or network connections fail, and it opens by recalling the Iberian blackout of April 2025.

No scheme document claims that offline card payments replace cash. The claim does not need to be made in writing to operate in the legislative debate, where the inference is readily available: if card payments continue during an outage, the resilience argument for cash acceptance obligations weakens, and so does the case for an offline component of the digital euro. That inference, rather than the technology, is the subject of this note.

The exercise is deliberately narrow. It does not assess whether offline authorization is desirable, since the evidence indicates that it is. It asks what offline card payments do during an infrastructure failure, what bounds their capacity, and whether those bounds are of a kind that further deployment would remove. The method is to rely exclusively on public primary sources and to state explicitly the conditions under which the conclusion would be wrong.

Three sources carry most of the weight. The first is the memorandum describing the agreement reached between Sveriges Riksbank and the Swedish card market in October 2025, which sets out the parameters of the only fully documented national offline framework in Europe (Riksbank, 2025b). The second is the Banco de España analysis of the payment system during the blackout of 28 April 2025, which uses transaction data from Redsys and remains the most detailed account of what determined continuity during a genuine systemic outage (Cremades, Esandi and Pérez, 2025). The third is the Eurosystem documentation on the offline digital euro, which matters because it describes a different settlement architecture under the same label (ECB, 2024).

The note proceeds as follows. Section 2 distinguishes three instruments by what they settle and when. Section 3 sets out the layers of infrastructure each requires. Section 4 identifies four bounded margins of offline card capacity. Section 5 derives the procyclicality of privately provided resilience. Section 6 turns to the blackout evidence. Section 7 states what offline payments achieve. Section 8 sets out falsifiable substitution conditions. Section 9 draws the policy implications.

2. A taxonomy of instruments under infrastructure failure

The term offline payment is applied to arrangements that differ in the economically relevant respect, which is what happens to the obligation during the disruption. Three categories should be kept apart.

Deferred authorization against issuer credit. This is the offline card payment. The terminal verifies that the card is genuine and that the PIN entered is correct, and executes the payment without a connection, provided the issuer has previously written into the chip the parameters authorizing the operation and the maximum permitted amount (Cremades, Esandi and Pérez, 2025). The merchant accepts the transaction at the card issuer's risk up to a per-transaction floor limit, and the transaction is stored and submitted for clearing once connectivity returns (Riksbank, 2025b). During the outage nothing has settled. What exists is a claim whose quality depends on an issuer the merchant cannot contact.

Pre-funded local settlement. This is the architecture the Eurosystem is developing for the offline digital euro, which would allow users to pay without an internet connection after pre-funding their holdings online or at an ATM, with settlement taking place directly in end users' devices (ECB, 2024). The instrument is a stock held in advance rather than a line drawn during the event, and the transfer is final at the moment of exchange.

Bearer settlement. This is cash. The transfer is final at the point of exchange, requires no device, no counterparty and no subsequent reconciliation, and the instrument received is immediately available for onward payment.

Table 1 sets out the dimensions along which the three differ. The rows are not a ranking. They identify the properties that determine behavior when infrastructure fails, and they make clear that the three

instruments are not substitutes for one another in the sense required by the inference described in Section 1.

Property	Offline card	Offline digital euro	Cash
What occurs during the outage	Authorization only; settlement deferred	Settlement in the users' devices	Settlement at the point of exchange
Who bears the risk meanwhile	The card issuer	Pre-funded, so no credit exposure arises	No counterparty
Nature of capacity	A credit line written to the chip	A pre-funded stock	A bearer stock
How capacity replenishes	Only on return to online authorization	By funding online or at an ATM	By any receipt, including from another person
Transferable between persons	No	Yes, device to device	Yes
Spendable onward by the merchant	No	No, business holding limit is zero	Yes
Eligibility	Conditional on credit standing	Open to holders of an account	Universal
Acceptance	Voluntary and scheme-governed	As provided by the Regulation	Legal tender

Table 1. Properties of three instruments under infrastructure failure. Sources: Riksbank (2025b); Cremades, Esandi and Pérez (2025); ECB (2024). The zero business holding limit for the digital euro is stated in ECB (2024).

3. The dependency stack

Resilience claims are frequently stated against a single point of failure, which obscures that payment instruments depend on several layers that do not fail or recover together. The blackout of 28 April 2025 provides the relevant illustration. The interruption began at 12:33, and the restoration of supply varied by territory, beginning in some areas late in the afternoon and in others not completing until well into the following morning. Communications were disrupted beyond the restoration of

electricity: in many areas connectivity did not return until two hours after power came back (Cremades, Esandi and Pérez, 2025).

Offline authorization addresses one layer only, namely the communications link between the acquirer and the issuer. It does not address electricity at the merchant, electricity in the consumer's device where the instrument is a mobile application, or the operation of the wider commercial process. The significance of this distinction is empirical rather than definitional, and Section 6 shows how it determined outcomes during the blackout.

One correction is required at this point, because it bears on an argument that is tempting and wrong. It is sometimes asserted that offline card payments fail during a blackout because the terminal loses power. The Banco de España analysis does not support this. Terminal battery life was not among the main reasons for the reduction in card activity, since such batteries typically last longer than the outage did, on the order of 72 hours at rest and 24 hours in use (Cremades, Esandi and Pérez, 2025, citing Redsys). The binding constraint lay elsewhere, in the electricity required by the rest of the establishment.

4. Four bounded margins of offline card capacity

The Swedish framework is the appropriate object of study because it is the most ambitious offline arrangement so far agreed in Europe and because its parameters are public. The agreement was reached on 3 October 2025 between the Riksbank, six issuing banks subject to its contingency regulations, Visa and Mastercard, the four largest Swedish acquirers, and representatives of food retail, pharmacy and fuel. Its stated objective is that card payments for essential goods should be possible offline in the event of disruptions lasting up to seven days, with implementation by 1 July 2026 (Riksbank, 2025b).

4.1. The reset condition

Two distinct limits operate, and public discussion has attended to only one of them. The first is the per-transaction floor limit, the amount up to which a merchant may accept an offline authorized payment at the issuer's risk. The second is the offline limit written into the chip, which is the total amount the cardholder may pay across one or several purchases. The Swedish memorandum states that this accumulated limit is reset when an online authorization is made with the card (Riksbank, 2025b).

This property, which may be termed the reset condition, is the central analytical fact about offline card payments. Capacity is a quantity rather than a continuing capability, and the only way to restore it is to re-establish the connectivity whose absence created the need in the first place. In Sweden the accumulated limit was calibrated to correspond at least to the cost of a household's purchases of

essential goods for one week, and merchants are required to be able to store offline transactions for up to seven days (Riksbank, 2025b). The calibration is therefore explicitly finite and explicitly bounded by a planning horizon.

It also follows that the per-transaction figure is not the novelty it is sometimes taken to be. The Swedish floor limit of SEK 2,000 is described in the memorandum as corresponding to the European standard of EUR 200 applied in several other countries, and as based on an assessment by the card networks (Riksbank, 2025b, n. 5). The EUR 200 ceiling reported in the October 2026 announcement is the existing European parameter rather than a new one.

4.2. Sectoral delimitation

Offline capacity is not available across the economy. In the Swedish framework the networks were to regulate a floor limit covering at least outlets selling essential goods, defined as food, pharmacy products and fuel, with such outlets identified based on the networks' Merchant Category Codes (Riksbank, 2025b). The capacity is therefore rationed by sector through an identifier assigned to the merchant, not held by the consumer.

Whether the same mechanism governs the wider European rollout announced in October 2026 cannot be established from public sources, and no claim is made here beyond the Swedish case. The announcement does describe the covered purchases in sectoral terms, naming supermarkets, grocery stores, service stations and pharmacies along with travel and ticket machines (Mastercard, 2026), which is consistent with but does not evidence a category-code implementation.

4.3. Eligibility conditioned on creditworthiness

The third margin has received no attention and is the most consequential distributionally. Because an offline authorized transaction is accepted at the issuer's risk, the function presupposes that the issuer is willing to extend credit to the cardholder for the duration of the disruption. The Swedish memorandum is explicit about the consequence. The arrangement does not cover customers who do not meet the conditions for obtaining an offline card, that is, those to whom overdrafts are not granted and who can therefore hold only a card restricted to online use. The largest single group in that category is young people under 18, for whom the memorandum provides that the card be replaced with one carrying offline functionality at its first expiry after that age, subject to the other conditions being met (Riksbank, 2025b, n. 3).

The ability to pay for food, medicine and fuel during an emergency is thereby made conditional on credit standing. Cash carries no such condition, and neither does legal tender status. This is not a design flaw that further rollout would remove, since it follows directly from the fact that the instrument is credit.

4.4. Non-circulation

The fourth margin concerns what happens after the payment. An offline card transaction is stored in the terminal and submitted to the acquirer once the connection is restored (Riksbank, 2025b). The merchant has received a claim that cannot be used to pay a supplier, an employee or a landlord during the disruption. Value enters a settlement system that is not operating and remains there.

Cash behaves differently in a way that is easy to overlook because it is so familiar. A banknote received by a shop in the morning can be paid out as change in the afternoon or passed to a supplier the same day, and the same unit can support several transactions during a single outage. The velocity of a bearer instrument under disruption is not zero.

That this is a recognized property rather than an incidental one is confirmed by the public design. Under the digital euro, business users such as merchants would have a holding limit of zero, meaning that they could not accumulate holdings of digital euro, although they would be able to make specific types of payment (ECB, 2024). The constraint is deliberate and it is stated. Neither offline arrangement reproduces the recirculation that cash provides.

5. The procyclicality of privately provided resilience

The preceding four margins are documented parameters. A fifth property follows from them analytically and does not require new data.

The size of the offline limit is set by the issuer, and the issuer bears the risk of the transactions it permits. Merchant acceptance is likewise a decision taken by the merchant at the moment of the transaction, under uncertainty about whether the counterparty's account will support the payment and about when settlement will occur. Both parties are therefore making a credit judgement whose terms deteriorate as the disruption lengthens, since the probability of a disorderly resolution rises with duration and the information available to either party does not improve while connectivity is absent.

The implication is that the resilience provided by this arrangement is procyclical with respect to crisis severity. It is most reliable in short, localized interruptions where the expected cost of a wrong judgement is small, and least reliable in the prolonged or systemic events for which contingency planning exists. An instrument that performs well in the mild states of the world and degrades in the severe ones is a useful operational tool, and it is not a contingency reserve.

This is not a speculative concern. Both authorities that have examined the question have identified the same unresolved issue. The Riksbank noted that the questions to be resolved included how abuse of offline payments could be curbed and who should bear the liquidity and credit risk arising from an

offline payment (Riksbank, 2025a). The Banco de España, considering how the functionality might be extended beyond the large retailers that currently use it, concluded that extension to the retail sector as a whole would require adapting card parameters and establishing a framework defining activation scenarios, priority sectors and the applicable liability regime (Cremades, Esandi and Pérez, 2025). The allocation of risk during the event is an open question in both jurisdictions.

6. Evidence from the Iberian blackout of 28 April 2025

The blackout provides the only recent European observation of a payment system under simultaneous loss of power and communications at national scale. The Banco de España analysis, based on data supplied by Redsys, compares activity on 28 April with Monday 7 April, selected because the profile of the hours before the outage closely resembled that date and because it avoids distortions associated with Easter.

The number of card transactions fell by approximately 55 per cent relative to the reference day. Measured by value accumulated from midday to the end of the day, card payments amounted to EUR 340.2 million against EUR 756.8 million on 7 April. The sectoral breakdown is reproduced in Table 2.

Sector	28 April	7 April	Change
Large distribution and food companies	147.0	225.0	−35%
Retail trade	45.0	148.0	−69%
Other categories	35.0	129.0	−73%
Travel and entertainment	28.0	64.0	−56%
Restaurants	26.0	69.0	−62%
Supermarkets	17.0	46.0	−63%
Service stations	23.0	43.0	−46%
Hotels	19.0	32.0	−41%
Rail passenger transport	0.2	0.8	−73%
Total	340.2	756.8	−55%

Table 2. Card payment value by sector, accumulated from 12:00 to end of day, millions of euros. Source: Cremades, Esandi and Pérez (2025), Table 1, from Redsys data. Category definitions are those of the original.

The distribution of the fall is more informative than its magnitude. Small merchants recorded declines exceeding 80 per cent at the most critical moments of the day, partly because many establishments closed. Large retailers held up considerably better, and the Banco de España attributes this to three cumulative mechanisms: the greater frequency with which they have electricity generation of their own, the possibility of authorising transactions offline, and in some cases the availability of autonomous terminals that permitted not only payment but also the issuing and recording of invoices, preserving the administrative continuity of the sale. The overwhelming majority of small merchants had none of these mechanisms, and so the activity could not take place (Cremades, Esandi and Pérez, 2025).

This is the finding that most directly bears on the substitution inference. Offline authorization did contribute to continuity, and it did so at establishments that had already solved the electricity problem by other means. It operated as the third element of a stack whose first element was a generator. The underlying constraint was that many businesses could not continue the commercial

activity itself without power, since computers, invoicing tools and weighing scales were unavailable (Cremades, Esandi and Pérez, 2025). Extending offline authorization to a shop without electricity does not make that shop able to trade.

A second finding must be stated with equal clarity, because it bears against a careless defense of cash. Access to cash also failed. ATM withdrawals are conducted entirely online and could not proceed once communications were lost, and fewer than 4 per cent of the Spanish ATM estate has an alternative power source. The operational autonomy of a typical machine under uninterruptible power supply is in the range of 10 to 20 minutes, designed to permit a controlled shutdown rather than continued service, extending to as much as 96 hours only where auxiliary generators are installed (Cremades, Esandi and Pérez, 2025, nn. 5 and 6). What functioned during the outage was the cash already in households' hands, not the channel that distributes it. The relevant distinction is between the stock and the distribution network, and the resilience claim for cash is properly made about the former.

The recovery profile is consistent with this reading. Against the reference days of 22 and 23 April, card payments fell by 55 per cent and then recovered by 9 and 33 per cent on 29 and 30 April; ATM withdrawals fell by 34 per cent and recovered by 114 and 105 per cent; Bizum transactions fell by 75 per cent and recovered by 78 and 132 per cent. The recovery did not fully offset the fall in the case of card payments, but it did in the case of Bizum and above all in cash withdrawals (Cremades, Esandi and Pérez, 2025). The sharpest rebound occurred in the instrument that households chose to replenish once they could.

It should finally be recorded that the financial infrastructures themselves performed. The TARGET services, the Spanish national clearing system, Iberclear and BME Clearing all operated without incident thanks to their contingency arrangements (Cremades, Esandi and Pérez, 2025). The failure of 28 April was not a failure of payment infrastructure. It was a failure of the electricity and communications on which the last mile of that infrastructure depends.

7. What offline card payments do achieve

The case set out above is a case about limits, and it would be misread if taken as a case against the instrument. Four points should be recorded on the other side.

First, offline authorization genuinely resolves the most common disruption, which is a loss of connectivity at a merchant that still has power. That scenario is far more frequent than a national blackout, and an instrument that covers it well is worth having.

Second, the technology is proven and already deployed. The Swedish working group adopted offline authorization via the EMV chip precisely because it is a well-established solution that already exists and works (Riksbank, 2025b), and the Banco de España observed it functioning during the blackout.

Third, the Swedish framework is serious public policy rather than a marketing exercise. It assigns obligations to named issuers, networks, acquirers and retailers, it calibrates the accumulated limit to a measurable household requirement, it requires terminals to attempt online authorization before resorting to offline (Riksbank, 2025b), and it is coordinated by the central bank under a statutory responsibility for payment preparedness.

Fourth, the direction of travel is correct. The Banco de España has concluded that greater availability and standardization of offline operation could constitute a fundamental pillar of a national payment resilience strategy (Cremades, Esandi and Pérez, 2025). Nothing in this note contradicts that conclusion. The disagreement, if there is one, concerns what else the pillar must stand alongside.

8. Falsifiable substitution conditions

To avoid an argument that cannot be tested, the conditions under which offline card payments would substitute for cash in a prolonged outage are stated here explicitly. Each is observable, and each would be satisfied or not by a published scheme parameter or regulatory requirement. Table 3 records the current position.

Condition for substitution	Status	Basis
Capacity replenishes without a return to connectivity	Not met	Riksbank (2025b)
Availability is not conditional on credit standing	Not met	Riksbank (2025b), n. 3
The instrument transfers between persons	Not met	Scheme design
The accepting merchant can spend the proceeds onward	Not met	Riksbank (2025b); ECB (2024)
Acceptance is obligatory rather than voluntary	Not met	Scheme rules
Operation does not depend on merchant electricity	Not met	Cremades et al. (2025)
Coverage extends beyond designated sectors	Not met	Riksbank (2025b)

Table 3. Conditions under which offline card payments would substitute for cash, and their current status. Any condition may be revisited against published scheme parameters; the note's conclusion would require revision if several were satisfied simultaneously.

The first four conditions are not matters of deployment. They follow from the instrument being a credit line written to a chip rather than a bearer stock, and no amount of further rollout alters them. The last three are in principle amenable to policy, and the Swedish experience shows that two of them can be moved by coordinated action. None is satisfied today.

9. Implications for the Legal Tender Regulation and the digital euro

The strongest evidence for the position taken here is not supplied by the cash industry. It is supplied by the two monetary authorities that have done most to extend offline card payments.

The Riksbank initiated the Swedish work in the autumn of 2024, led the working group, and coordinated the agreement that takes effect on 1 July 2026. In March 2026, the same year in which the arrangement enters into force, it published recommendations advising households to keep SEK 1,000 in cash per adult at home, where possible in several denominations, to use cash at regular intervals so that the cash system continues to function, and to hold at least two cards from different card networks (Riksbank, 2026b). Its Payments Report maintains that it must be possible to pay for essential goods both with cards offline and with cash, and that work should continue to enable offline functionality for other payment methods (Riksbank, 2026).

The Banco de España, in the same section of conclusions in which it proposes extending offline functionality, proposes complementarily that campaigns be promoted encouraging households to keep a small cash reserve sufficient to meet a minimum volume of expenditure during disruptive events, and to be informed about the importance of having alternative means of payment available. It also notes that installing generators in ATMs appears costly and may entail security and logistical risks in crisis situations (Cremades, Esandi and Pérez, 2025).

Neither authority treats offline card payments as a substitute for cash. Both treat the two as components of a portfolio, and both continue to address the household cash stock directly because that is the component that functioned on 28 April. The legislative question is whether the European framework will reflect that reading or the simpler one.

Two asymmetries are relevant to the trilogue on the Legal Tender Regulation. The first concerns who decides. An offline limit is a parameter set by an issuer under scheme rules, and it can be reduced, suspended or differentiated by merchant category at the discretion of private parties, including in response to the very conditions that make it valuable. Legal tender status is not revocable in that way. The second concerns who is covered. Scheme-based offline capacity reaches those whom issuers are willing to extend credit to, in sectors the networks have designated, at merchants who choose to accept. A legal tender obligation does not depend on any of these judgements.

For the digital euro the implication is different and more specific. Because the offline digital euro is designed to settle directly in end users' devices after pre-funding (ECB, 2024), it belongs to a different category than offline card payments and cannot be regarded as duplicative of them. The Eurosystem has also acknowledged the power dependency explicitly in its own design work, contemplating a bridge device, described as a simple pocket-sized battery-powered device for establishing a connection channel between two unpowered smart cards (ECB, 2024, n. 1). A public offline instrument that settles is not made redundant by a private offline arrangement that defers.

10. Conclusion

Offline card payments are a real improvement in payment resilience and should be extended. They are also a credit instrument with a finite capacity written onto a chip, which replenishes only when the connection that failed is restored, which is delimited by merchant category, which is available to those whose credit standing permits it, and which does not circulate once received. These are properties of the instrument rather than of its current stage of deployment.

The evidence from 28 April 2025 indicates that offline authorization contributed to continuity principally at establishments that had already secured their own electricity, and that the instrument whose use rebounded most sharply once the system recovered was cash. The evidence also indicates that the cash distribution channel failed, which is a finding for the cash industry to absorb rather than

to contest, and which makes the household cash stock, rather than the ATM network, the relevant object of contingency policy.

The risk in the current debate is not that anyone will claim offline cards replace cash. It is that the claim will not need to be made. Both the Riksbank and the Banco de España have extended offline functionality while continuing to recommend that households hold cash, and the European framework should be built on that reading rather than on the inference that the announcements invite.

References

Cremades, L., Esandi, Á. and Pérez, M. (2025). El impacto del apagón del 28 de abril de 2025 sobre los sistemas de pago en España. Revista de Estabilidad Financiera, Banco de España, 49, autumn. DOI: 10.53479/41868.

European Central Bank (2024). Progress on the preparation phase of a digital euro, 24 June 2024.

Mastercard (2026). Mastercard to keep payments moving during power and network outages across Europe. Press release, Waterloo, October 2026.

Reserve Bank of India (2024). Framework for Facilitating Small Value Digital Payments in Offline Mode, updated as on 4 December 2024.

Sveriges Riksbank (2025a). Payments Report 2025, 10 March 2025.

Sveriges Riksbank (2025b). Increased possibilities to make offline card payments in Sweden. Memo, DNR 2025-01171, 3 October 2025.

Sveriges Riksbank (2026). Payments Report 2026, 12 March 2026.

Sveriges Riksbank (2026b). New recommendations for public payment preparedness, 4 March 2026.