

Urgently Needed: Investment in Financial and Information Infrastructure for SMEs

Motivation: The Current Virus Situation and Need for a Broader Policy View

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In light of the impact of Covid19 virus on the economy, it's now much more obvious that SMEs are an integral part of how economies are put together, the backbone. The virus itself, an aggregate shock, and unanticipated, does require injection of immediate aid and relief. But the currently implemented policies are far from successful. The point is twofold: One, the ability to target ex post efficiently through existing information and financial infrastructure is limited, and two, we need better ex ante designs to mitigate chronic and acute problems that re-occur.

Outline: This proposal proceeds as follows. In the next section, we highlight the vulnerability of SME supply chains to Covid19 . Then, for the rest proposal below, we discuss specific designs for improved financial and information infrastructure, taking one thing at a time. In particular we start with the objects which need to be created, namely smart contracts with options, then to securitization of individual contracts, then move to supporting data base considerations, next the ways these contracts/data objects can be traded, and finally the appropriate regulatory framework.

Supply chains in particular are a key part of commerce in many sectors. But by their very nature, supply chains create vulnerabilities. When a link is broken, adverse impact can propagate up and down stream with collateral damage to input suppliers and output purchasers along the chain. This can have far reaching and large consequences. To draw an analogy with Covid19, the Fukushima earthquake, with its tidal wave and Daiichi nuclear power plant failure, spread problems well beyond the area of direct damage, to undamaged areas through supply chains. The event became an aggregate shock, with a substantial drop in Japan's national output. With supply chains, specific adverse shocks, which in principle could be mitigated if not eliminated through pooling and though the ex-ante bearing of risk, get amplified.

The extent of insurance in practice is problematic. Informal networks in some countries provide a safety net of sorts for those SME who are covered, for example with friends and family. Managing accounts payable and receivable among firms in supply chains as a group can help. But both these are informal arrangements, typically limited relative to the overall scope of the problem. That is supply chains do not explicitly extend and organize risk-pooling beyond bilateral links.

A solution consists in improved electronic marketplaces, broadly defined, and a data base information infrastructure. These can be combinations of private public partnerships. But the main point is the use of new technologies. Now is the time to innovate. Progress will not happen automatically.

Blueprints for Information and Financial Infrastructure

Here we lay out key ingredients and a list of innovations:

Contracts as the object traded.

First, what objects should be traded. The most effective devices and contracts are not single dimensional, e.g., more credit, but rather appropriate contracts among willing parties with contingencies. Sometimes these are formal and transparent. To list some familiar examples: covenants are clauses in debt contracts which can stipulate which investor has priority in repayment. The option for early payment in mortgages is standard, as are certificates of deposit which allow early withdrawal, with penalties. Another example: retirement savings with conversion options, annuities versus lump sum. Sometimes these options are informal, as in relationship lending. A commercial bank with a secure deposit base is more lenient when good customers are under stress, rolling over loans, though with monitoring.

The needed innovation in this context: Smart contracts that allow formal automation of informal relationship lending, with the tools of cryptography enabling options and agreements among strangers. As is evident in analysis of data, SME's live in a variety of information and financial regimes, sometimes woefully incomplete, but sometimes relatively sophisticated. Just as the latter regimes are written down and computed in economic analyses, such contract regimes can be implemented in practice in lines of code. Homomorphic encryption and multi party computation allows protection of privacy. The messages sent to execute options of the contract between borrower and lender, or insurer and insuree, are encrypted and remain private, seen by no one. The code of the contract replaces a third-party intermediary, with protection against abuses, plus committing all sides. Risk can be priced, allowing insurance against idiosyncratic firm-specific shocks by pooling, and allowing the sharing of macro aggregate shocks.

Securitization

Securitization is the principle of pooling loans over multiple borrowers, potentially backed by collateral, and typically tranching into risk classes. We have this in the US for mortgages underwritten by federal agencies and for the guaranteed part of SBA loans. Some private sector securitization exists, for syndicated loans, for private-placement mortgages, and for P2P lending platforms. The belief persists that SME loans are difficult to securitize, but this is belied by actual practice, particular so in Europe. Securitization happens, but the scope is limited.

The innovation here is a combination of programmed smart contracts, pooling individual contingencies and events as is standard, but here using cryptographically secure private data. Not all data acquired from borrowers should be available to investors. But some of it is useful. Partial information, rather than the endpoints, completely private vs full disclosure, can be the new optimal design, to prevent unravelling.

Securitization is related to accounts payable/receivable and waterfall payments in supply chains. A supplier that is not yet paid receives a trade receivable promise that can be sold. The promise can be written as a smart contract with collateral in escrow to help ensure eventual payment by the borrower/ purchaser, an SME or larger business with the corresponding trade payable. As digital assets on ledgers, a secondary market can be developed, with the requisite data, parts of financial accounts, with documents hashed to prevent tampering, accessible to eligible participants. Further, SMEs connected to each other are in situations with waterfall payments; goods flow downstream, from natural resources to retail, and payments flow back upstream. SMEs in supply chains can manage their accounts payable and receivable collectively in order to pool risk more explicitly, as in a constrained-optimal multi-party mechanism. The state variable of the code of the contract and its contingencies is not the bilateral state of two parties but multi-lateral state across all parties in the chain. A pre-existing mechanism of this sort would also help with the injection of external liquidity by the Federal reserve, as need be in future adverse events; current it has been hard to target liquidity to where it is most needed, to downstream firms where it provides the most external benefits.

Data base infrastructure: creation, access, and use

Banks as lenders acquire data on applicants and potential customers, as do insurance companies, but they largely keep the data in-house. Governments administering aid and loan programs are reluctant to burden banks with reporting requirements, and some client insurance information is arguably private. Yet current targeting is inefficient, or worse with reported abuses.

Some remedies are apparent in contemporary settings, though not implemented at scale. Fintechs for SMEs offer liquidity management and payables/receivables management services based on analysis of data from customers who provide links to their financial accounts. Other data are available as though credit and debt payments processors, used for analysis of Covid19 impact though observed expenditures patterns but not used as part of tailored financial products, unlike the data base of payment providers in some other countries. An SME data base was created in Europe by lenders as a basis for asset-backed securitization of SME loans, used as collateral in repo. The problem is that each these solutions are as yet piecemeal and do not take advantage of advances in cryptography.

Related and symptomatic of the problem, the data bases we have now are not put into a coherent whole. We do not have comprehensive integrated financial accounts on most households and SMEs. The excellent households surveys we do have, including those running small business, do not have balance sheets which are consistent with income statements and cash flows. The integrated macro accounts of the US are to be applauded for making that conceptual link but suffer from an errors and omissions category for reconciliation of stocks and flows, as data come from different agencies and are not gathered with the idea of integrated financial statements in mind. Integrated accounts available at the local, state, or national level.

For the innovation, we need to utilize better existing data, organize across data sets, create new data as needed, and rely more on electronic transactions. Privacy aspects are key to protect customers and provide incentives for participation. Multiparty computation allows encrypted line items in financial accounts to be aggregated for analysis while preserving total privacy. Financial institutions and larger corporations can pool. Analysis on encrypted data can be used for public policy and for key states in private financial instruments. New infrastructure would not rely on big private tech firms for data management. With modern cryptanalysis, we need not rely on trusted third parties.

The matching of parties and trading of contracts

Circle is a P2P platform operating in the US linking investors to SME loans. Such platforms can rely on matching algorithms or auctions. Lending Club and Prosper are P2P platforms that rate applicants, including loans for non-corporate personal businesses run by households, and pair loans to investors, sometimes in multi-loan securitized portfolios, as noted above. However, the auction schemes they use are organized typically by a third party, as in Mortgage Capital Trading's use of a Trade Auction Manager.

Such a central third party is not necessary anymore. Improved infrastructure for auctions and matching comes from a combination of various pre-existing ideas in economic literatures, now implementable with new technology. The tools of cryptography, homomorphic encryption and multi-party computation allow bidding without auctioneers with bids kept entirely private. Participants need not worry they are revealing information or beliefs. Inter-dependent private values can be accommodated with auctions that are largely detail free, ie work for a variety of environments. Related is secure aggregation of information on bids and also bidding with contingencies on the bids from other, all of which can be kept secret, with neither bids nor the distribution revealed. Randomized outcomes and mixtures can be used in better design of auctions, to exploit better selection of bidders that vary in risk aversion and more efficient bidding. Such lotteries are frequently used in encryption. Modeling can be used to determine the frequency of auctions, that need not be run continuously, or the opposite, to automate bidding in real time, depending on the context. Smart contracts implement dynamic programs. Likewise, when information is not the obstacle, competitive outcomes can be implemented even with few traders on a platform, with appropriate design of strategy spaces and outcome functions. Or when idiosyncratic information is the problem, thicker markets made possible by trade with strangers, under the new technology, mitigate information/implementation problems. Matching among new partners can be weighed against matching in repeated sustained relationships. The tools of linear programs and assignment problems can be made operational to determine overall designs.

Ensuring Competition across Platforms

The supposedly trusted third party running a platform, hence subject to information and market power abuse, can be replaced by algorithmic rules for trade and information release. Again, no third parties; the platforms are created by the participants themselves. Ex-ante

competition across platforms offering contracts can help ensure ideal competitive outcomes. Even with increasing returns to scale, the economics of the problem can lead to finite-sized trading groups with no rents. However, governments and regulation are needed for optimally designed playing fields. For example platforms should compete ex ante for customers but not ex post as events occur, as that can make implementation of incentive contracts more difficult. Likewise, ex ante optimal design can be facilitated by judiciously chosen segmentation, with agents choosing which exchange use, paying for rights to trade there. In the current contemporary landscape, with incomplete contracts and securities, there are synergies among firms offering complementary contracts that should be allowed, as otherwise there is a kind of coordination problem which can block innovation.