Granularity and Digitalization: Challenges for Monetary Policy[1]

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The Challenges from Digitalization

Inflation-targeting (IT) central banks evaluate economic conditions and forecast variables of interest for their decision-making process using a suite of econometric and theory-based economic models. To this end, central banks collect data on a wide array of macroeconomic and financial variables. Information demands follow directly from the policy requirements of IT regimes: a formal commitment to a specified rate of inflation, a designated measure of inflation, analytical tools to forecast inflation and to examine the monetary transmission mechanism and the central bank's ability to influence inflation, and a communication policy.

Central banks execute their policy strategies through the implementation of monetary policy, while regularly monitoring a number of real economic indicators, i.e., both demand- and supply-side variables, to ensure early detection of possible inflationary pressures and through the understanding of the transmission mechanism of monetary policy. Moreover, central banks are constantly expanding the availability of economic, monetary and banking information along with data on the financial flows in order to enhance monetary policy effectiveness. IT regimes center on forward-looking indicators and channels of monetary policy transmission, such as the interest rate, bank lending, assets prices, balance sheets, exchange rates, expectations, property occupancy rates and labor market information (employment dynamic and wage and compensation indices).

During the last years, profound disruptions —automation, artificial intelligence and new business models such as the "sharing economy"— are starting to shift the way we work, trade, consume and live. Most countries are pushing the boundaries of their "digital evolution" (Figure 1). On the one hand, these developments have made the proper measurement the economic and financial phenomena more challenging. The traditional framework for measuring national accounts, which is mainly restricted to an economic model where primary and secondary production would explain the behavior of total value added, is particularly challenged by these developments. This framework emphasizes the accurate representation of the process of transforming basic inputs into final products by a representative, or average, agent --For instance, a firm that delivers a homogeneous good to a household. In the present day, however, digitalization and financial innovations put into question the usefulness of this paradigm. The digitalization of economic relationships, leading for instance to activity best described as part of the "sharing economy", makes a clear-cut distinction between producers and consumers harder to pinpoint. Moreover, the diverse way in which individuals and firms can organize themselves into economic activities

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renders more obsolete than ever the notion that a representative agent is a reasonable assumption to describe aggregate behavior. The bundling of experiences and demands for goods and services, which in the past were provided by well-defined products, will make the identification and measurement of the prices of these goods and services, and hence inflation, much more difficult.

On the other hand, the transmission mechanism of monetary policy also is likely to be shifting. One key channel of transmission of monetary policy is through asset prices and credit flows, particularly the exchange rate and cross-border capital flows. (Figure 2) It has been noteworthy how the globalization process, begun in the early 1990s, has resulted in a rapid and unprecedented integration of a disparate set of economies into global finance. The rise of mechanisms to facilitate cross-border lending and skip regulations, such as crypto-assets, is likely to make in the future these types of transmission mechanisms stronger.

The dispersion of economic activities across jurisdictions highlights the importance global value chains (global production), and the decentralized use of knowledge and intellectual property (technology, know-how) obtained in a centralized way (R&D). For instance, according to the international evidence, with globalization and the development of global value chains, exports are increasingly composed of imported inputs, a phenomenon which requires a careful calibration of the traditional exchange rate transmission mechanism to net exports implicit in our economic models. (Figure 3)

Thus, digitalization poses significant challenges going forward to the measurement of economic activity as well as for the transmission of monetary policy. Some of these challenges will be quite present in the near term, others more in the distant future. But in any case monetary policy authorities will need to be cognizant of these developments to understand and calibrate their policies to achieve their goals.

The Need for Granularity

There are however some challenges that need be undertaken in the most immediate term, that will help face the challenges coming in from digitalization further down the road. These relate to the need to increasingly incorporate into the assessment and design of monetary policy the granularity of current economic trends.

Price microdata

An adequate response of monetary policy to shocks depends on the proper understanding of price dynamics. Consumer price index microdata reveals a highly heterogeneous price-setting process in the economy. Figure 4 shows that in the case of Chile, in spite of inflation being well anchored in the target for many years, the extent to which individual price volatility differs from the average is striking, showing that there is considerable dispersion in the price-setting behavior across different sectors and over time.

Moreover, the changing quality of goods and services produced has become a challenge as it separates real growth from price evolution. The exact separation of these components is difficult to quantify and thus imposes a quota of uncertainty in the measurement of inflation and the appropriate policy response. Furthermore, the provision and consumption of services has also evolved, leaving behind the traditional way of providing services (such as Uber, Airbnb, Netflix, and others), so efforts should be made to collect and analyze them appropriately considering the granularity of the individual services they provide.

Labor market microdata

It is worth mentioning that measuring labor's contribution to output has become more complex by new developments such as the increase in female labor participation, significantly more school years, immigration, self-employed services providers, and technological advances pushing out low-skilled workers, among others. In this setting, traditional measures of slack in the labor market, such as the unemployment or the employment rates, lose significance. This has been a feature of the economic landscape in a number of economies after the Great Recession. One direction to help understand the changing role of the labor market in driving wage and inflationary pressures should come from the availability of timely and granular information, encompassing not only demographic and employment characteristics, but also the link to labor market outcomes in terms of wages.

From a macroeconomic perspective, shedding light on the forces shaping nominal wage developments could inform the debate on the extent of slack in the economy and the appropriate pace for exiting from accommodative monetary policies. A better understanding of the labor market evolution and forces that weigh on wage growth is therefore important for assessing the appropriate course of monetary policy. In particular, labor market micro-data could provide important Insights into the drivers of wage dynamics and the role of part-time employment, temporary contracts, and the role of immigration, where skill-mismatches might have relevant effects on wage setting, income inequality and causes for employment termination. Needless to say, the relevance of this area goes well beyond the conduct of monetary policy.

Financial data

Borrowing structure stands as other relevant element for monetary policy, underscoring the need for close and timely monitoring of credit sources. The development of credit among firms is one element to watch closely, first because of its precarious or non-existent regulation and, second, because of its substantial conditioning on the cyclical behavior of economic activity. The reliance on average behavior proved woefully inadequate in the run-up to the Great Financial Crisis. The fact that credit events in a very narrow slice of a specific market, such as sub-prime loans, had eventually systemic implications for the global financial system should always remind us of the importance of understanding granularity in individual behavior.

Although there have been major advances in the availability of more and better information from the financial sector after the Global Financial Crisis, progress in increasing granularity is also needed, primarily in banking commercial loans and household credits on a borrower-by-borrower basis with hopefully complete coverage. On the firm's side, it would be ideal have firm's credits on a consolidated basis including unregulated credit providers (e.g., financial leasing and factoring companies). The uneven progress in achieving a high coverage in credit registries is an example that work needs to be pursued more in this area. (Figure 5)

Loans statistics provide key data for the analysis of monetary developments and the monetary policy transmission mechanism. For example, information about renegotiated loans, allows measure the gross flow from bank loans issued to the real economy and breakdown of outstanding loan amounts by residual maturity and interest rate reset period provides for a more thorough examination of the transmission of monetary policy measures.

Moreover, having access to debt market data —by issuer and holder— allows knowing the forces that determine the shape of the yield curve providing useful information for policymakers about real market expectations of future interest and inflation rates.

Identifying the recipients of financing for today's monetary policy requirements is not enough; it is necessary to characterize their behavior, solvency and vulnerability –for example– in in the face of an economic slowdown, to predict the effects on business spreads, employment and salaries. A balance-sheet approach highlights the fact that macroeconomic policies adopted in response to shocks may be constrained by domestic balance sheet mismatches. For example, tight monetary policy aimed at preventing an excessive real depreciation may protect balance sheets with large currency mismatches (e.g., the corporate sector); but at the same time higher interest rates create further pressures on balance sheets with significant maturity mismatches (e.g., the banking sector) and increase the cost of credit for consumers and firms.

Cross border spillovers

Cross-border spillovers of monetary policy have traditionally been at the center of international policy debates, and particularly since the onset of the Global Crisis. Understanding the channels through which one country's monetary policy affects the international economy is an ongoing research agenda – including spillovers via internationally active banks. For domestic transmission, understanding heterogeneity in individual banks' responses to monetary policy shocks has shown to be critical. Because banks' decisions play a central role in the global economy and the effectiveness of monetary policy, understanding the sources and drivers of heterogeneity is at least equally important. Unfortunately, cross-country evidence on banking industry heterogeneity is difficult to obtain by confidentiality of individual banks data.

Disaggregation is critical to shedding light into the black box of monetary policy transmission across borders. The traditional channels of monetary policy commonly discussed in the literature,

were formulated using mostly aggregate data, and focused on average effects. The International Banking Research Networking (IBRN) studies using individual bank-level data for a more diverse group of countries find evidence of significant spillovers, and show how heterogeneity across banks drives different rates of transmission into domestic private lending among banks. In fact, the types of frictions and market structures that determine spillovers are not common for all economies and deserve closer attention, as revealed by the in-depth (bank level) cross-country initiative.

Moreover, the rise of alternative mechanism for financial intermediation is likely to deepen over time. It can be noted that those jurisdictions where crypto-assets have become more popular, and where authorities have shown a more restrictive approach to them, are also those where overall controls on financial integration is more acute. This points towards a future where the ability of different jurisdictions to impose controls on cross-border capital flows will be diminished compared to the past. (Figure 6)

The potential of merging administrative data

All these elements pose challenges to the monitoring of main macroeconomics variables and invites policy makers and statisticians to look for best ways to reflect theses phenomena and explore new sources of information for their estimation. Meanwhile, technological advances have facilitated the processing of large volumes of more granular data information. Among other benefits, these advances facilitate our understanding about broader moments of the distribution of firms and households along particular dimensions, which is key for enhancing the effectiveness of targeted policy decisions.

That said, the availability of data for monetary policy conduct could be improved. However, simply increasing the volume of data may not be enough to significantly improve policy effectiveness. Having more information at hand can help make timeliness and appropriate decisions, but only insofar those responsible for monetary policy are able to correctly analyze and interpret the data. This involves challenges for research, statistics, and economic modelling.

While new data sources open new opportunities for applied economic research, one area where most countries lag behind their potential is in the availability of high quality, merged administrative data. Due to confidentiality issues and inter-department bureaucracy within different government branches, large data sets (often censal) capturing different aspects of firms and households remain isolated and of limited use. For instance, and going back to the question of price dynamics at the micro level, tax records may provide very useful information about the behavior of margins at the individual firm level. But this analysis could be greatly advanced by merging tax data with customs information, which typically records every single cross-border commercial transaction. Combining these information sources, one could study exchange rate pass-through determinants at the border, the behavior of margins, and the final pass-through effect on consumer prices. Analogous matched data sets can be designed to better understand economic linkages in a variety of economic areas, such as the relation between educational

attainment (including specific degrees, educational institutions, grades, etc.) and labor market performance; exchange rate fluctuations and inter-industry reallocation of labor and capital; and the impact of market structure and industry concentration on productivity growth, among many other important topics.

Merged data can also be used as a powerful tool to inform monetary policy decisions to the extent it is available at high frequency and with a modest lag. In the case of Chile, a good example comes from a recent law requiring all firms to conduct all inter-firm invoicing of VAT electronically. This allows the tax office to receive millions of purchase/sales invoices between all firms operating in the economy every single day. By itself, this data can be treated to provide good real-time proxy of economic activity –since value added can be extracted from every single transaction—and inflation –invoicing records provide both quantities and prices separately. However, merging this data with additional sources, such as bank records, could be used to provide early warnings about systemic events, since it would include not only the complete network of transactions between firms, but also the exposure of banks and financial institutions to individual firms and/or particular industry clusters. For example, real-time performance indicators can inform whether a firm operating in a highly centralized node within the network is facing trouble, the likelihood that such difficulties would spread to other firms in the network vicinity, and the potential impact on the financial sector.

With most high quality data sets still kept isolated within particular governmental agencies in many countries, a global effort to bring these information sources together should be a key priority to governments and central banks in order to strengthen the quality of analysis guiding economic policies in general, and monetary policy in particular.

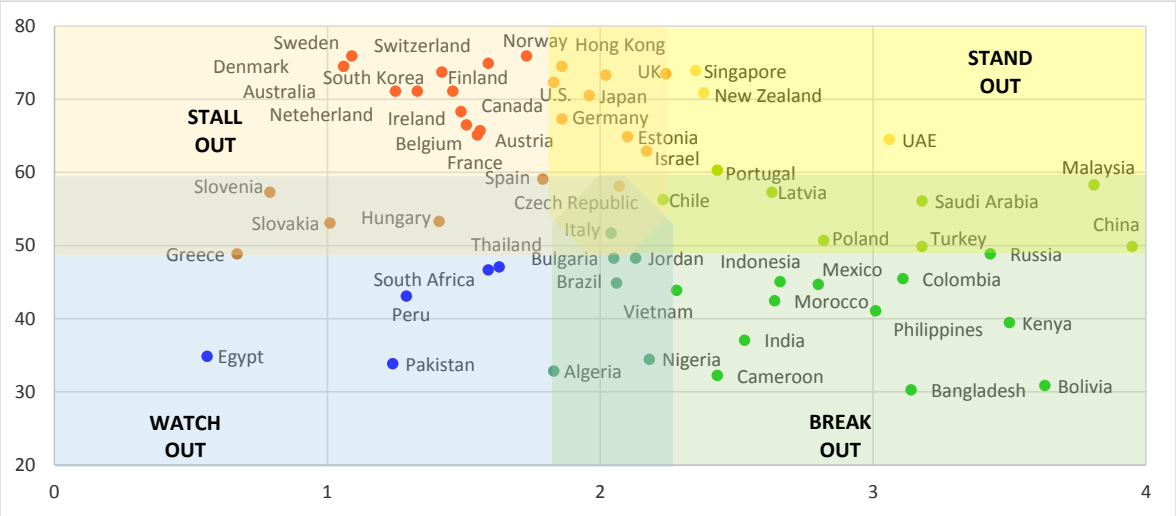
Some concluding remarks

The use of the representative agent framework for implementing monetary policy and for measuring the macro economy has served the central banking profession well. However, the increased digitalization of economic activities implies that not only the measurement of economic relationships such as output, inflation, and demand, become more challenging, but that the transmission mechanism of monetary policy will also likely shift. Central banks need to be cognizant of the difficulties these trends pose for the achievement of their objectives, which involve short, medium and long term challenges for statistics, research, and model development. In the more immediate future, a fruitful approach stems for the merging of administrative data. On the one hand, this provides an enhanced granularity in assessing economic behavior by heterogeneous agents. On the other, the need to understand and process this data is by itself a good stepping stone for further challenges down the road that derive from the digitalization of the economy. Statistical agencies and central banks are moreover adequately placed to preserve the integrity and anonymity of reporting entities, whether they be household, financial or non-financial corporates, a topic that in itself deserves a deeper study.

Thank you.

Figure 1 - Digital Evolution Index, 2017

(Index, rate of change indigital evolution, 2008-2015)

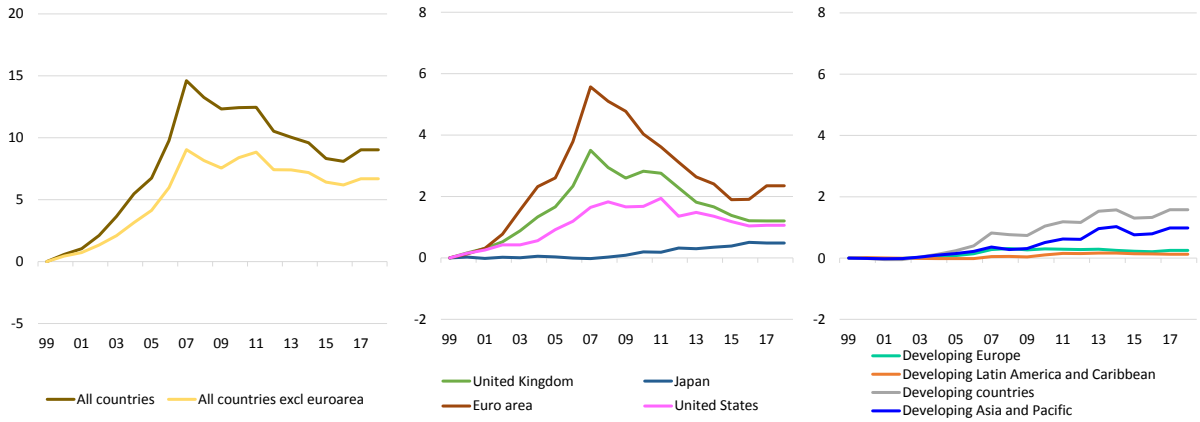


Note: Digital Evolution Index is a data-driven holistic evaluation of the progress of the digital economy across 60 countries, combining more than 100 different indicators across four key drivers: Supply Conditions, Demand Conditions, Institutional Environment, and Innovation and Change. Stand Out countries are both highly digitally advanced and exhibit high momentum. Stall Out countries enjoy a high state of digital advancement while exhibiting slowing momentum. Break Out countries are low-scoring in their current states of digitalization but are evolving rapidly. Watch Out countries face significant challenges with their low state of digitalization and low momentum; in some cases, these countries are moving backwards in their pace of digitalization.

Source: Digital evolution index 2017, Fletcher School at Tufts University and Mastercard.

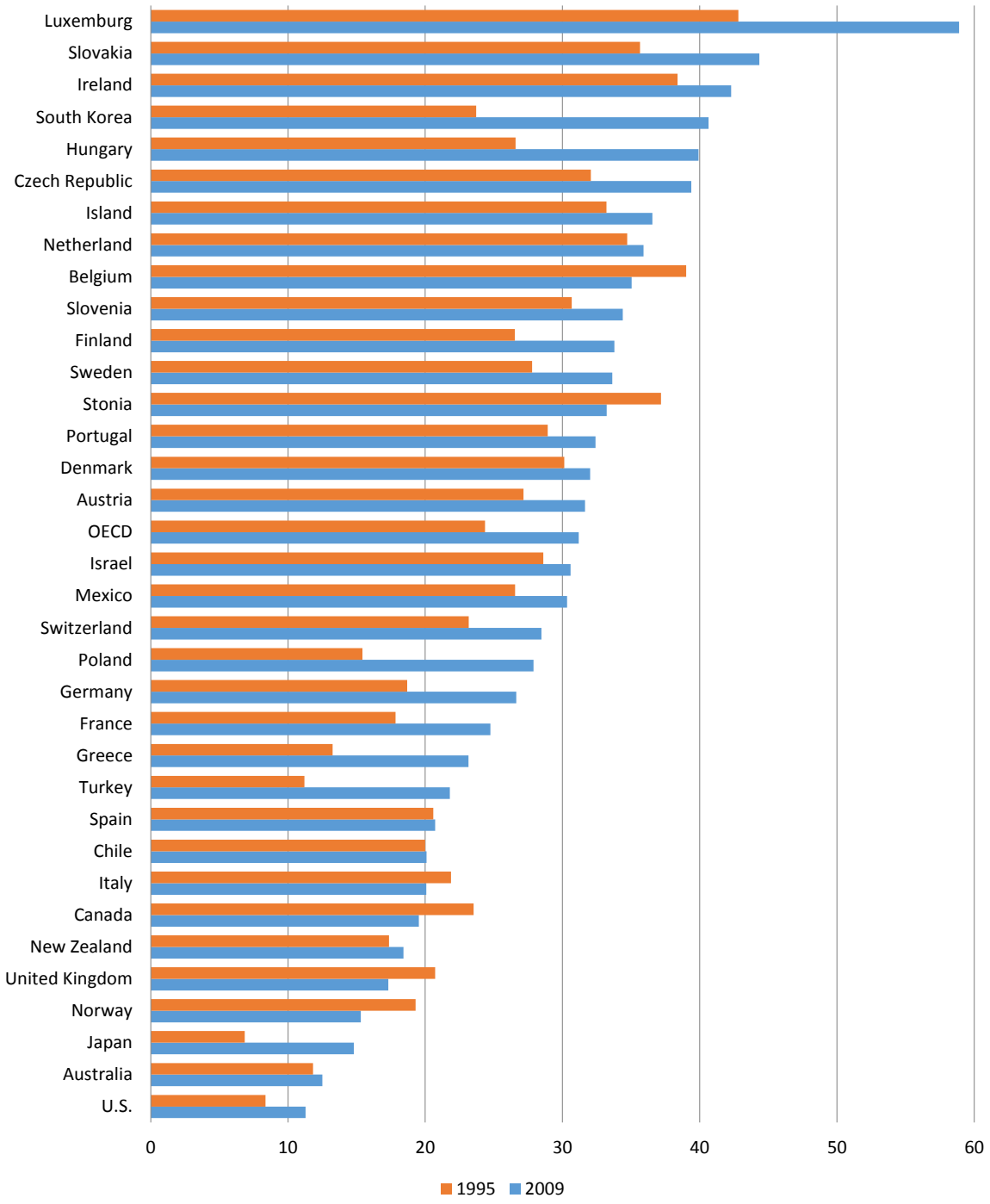
Figure 2 - Cross-border Bank Lending by Destination

(cumulative changes since end 1999, US$t)



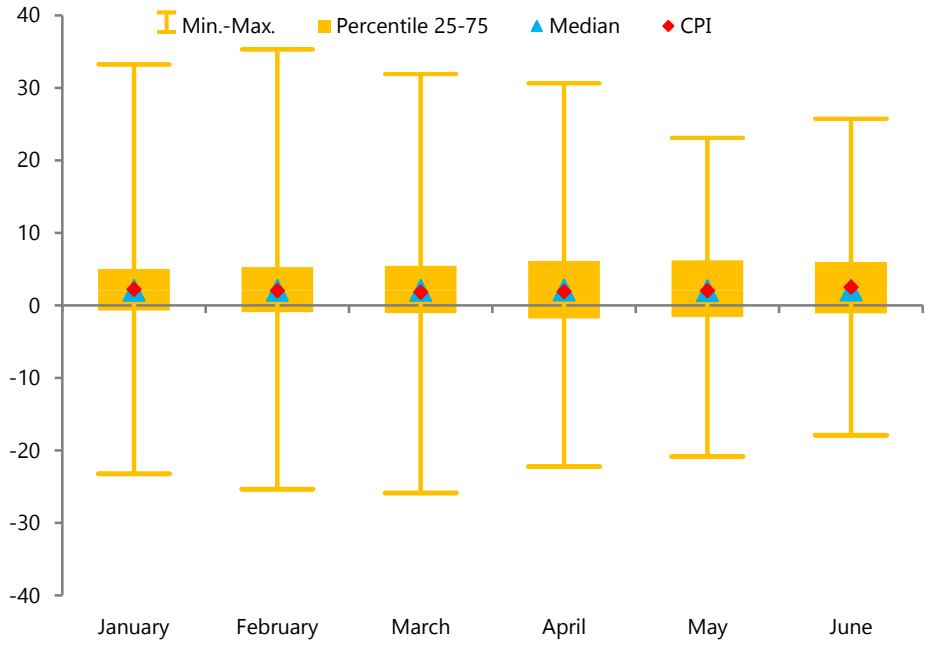
Source: BIS Locational Statistics.

Figure 3 - Imported inputs in total exports, 1995 and 2009
(percentage of gross exports, current prices)



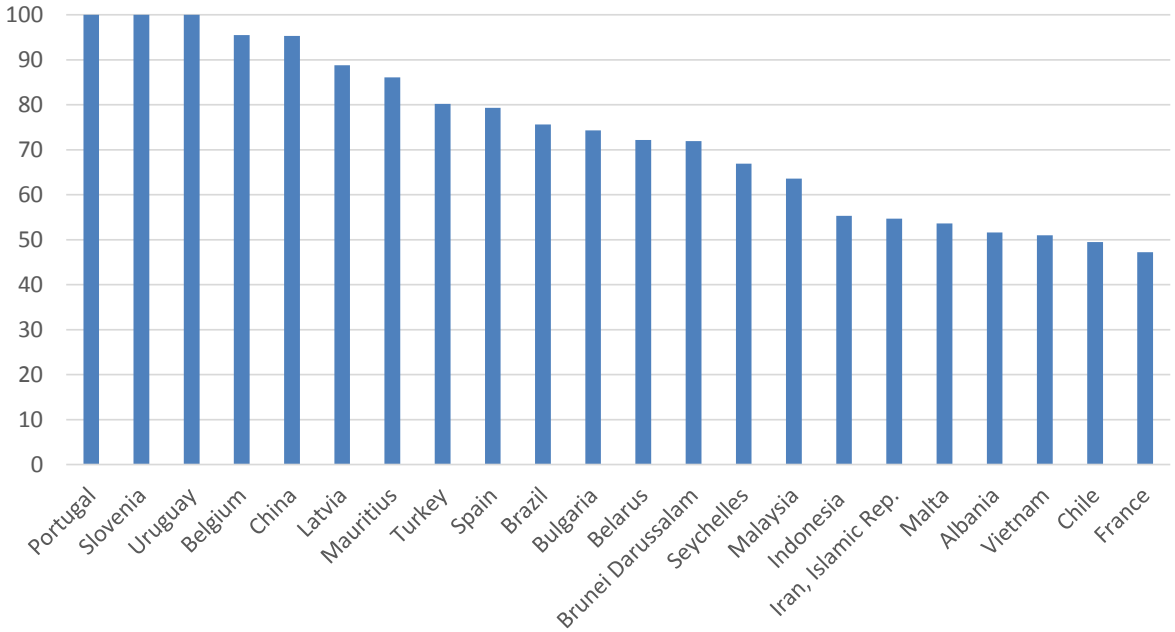
Source: OCDE – WTO Trade in Value Added (TIVA).

Figure 4 - Chilean CPI: price annual changes by product, 2018.
(percentage)



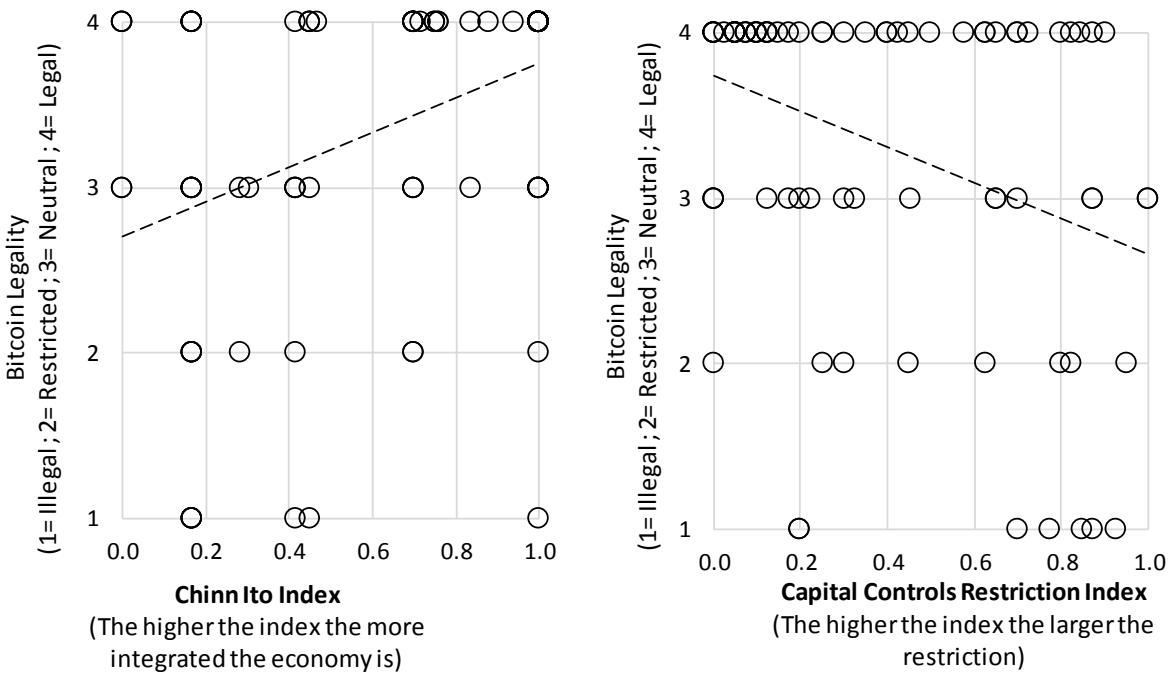
Source: National Statistics Institute (INE).

Figure 5 - Credit registry coverage
(as a percentage of the adult population)



Note: number of individuals and firms listed in a credit registry (database managed by the central bank or the superintendent of banks) as percentage of adult population.

Figure 6 – Bitcoin legality and overall foreign exchange restrictions



Sources: Coin Dance; Chinn, Menzie D. and Hiro Ito (2006), "What Matters for Financial Development? Capital Controls, Institutions, and Interactions", Journal of Development Economics, Volume 81, Issue 1, Pages 163 – 192 (October); Fernández, Klein, Rebucci, Schindler and Uribe (2016), "Capital Control Measures: A New Dataset", IMF Economic Review, Vol. 64 (3): 548-574, 2016.