Growth and financial reforms trajectory: an optimal matching sequence analysis approach

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Abstract

This paper makes two important , even if preliminary, methodological contributions to the financial reforms literature. The first contribution is that it introduces a new framework for the metric of sequence analysis, namely, Optimal Matching Sequence Analysis. The second is that it provides an innovative framework namely synthetic counterfactual approach for the assessment of the impact of financial reforms sequence. It shows that the trajectory of financial reforms followed by countries, affects the level and the volatility of GDP per capita growth.

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1 Introduction

"What changes more often, the fashion designs coming from Paris, Milan or the economic policy designs Washington and Wall Street prescribe to countries that are less developed or that are emerging from decades of communism?...

The difference, of course, is that economic policy fashions affect the way millions of people live and define their children's chances for a better future."

Moises Naim, Foreign Policy Magazine (IMF,1999).

The financial opening belongs to the most important and at the same time, least understood aspects of economic reform. Indeed, if there is a relative consensus about the ultimate objective of financial reforms, the debates over financial reform in general appear to have shifted from whether to reform to how to reform. A substantial literature on the sequencing of economic reforms emerged in the mid 1980s prompted by a desire to understand the disappointing experiences with liberalization in the Southern Cone of Latin America. Two main points of view emerged from this literature. The first one supports the idea that there are substantial welfare gains to be reaped by giving freer play to market forces. The second one has concluded that there are problems inherent in the transition process itself that argues against liberalizing all markets simultaneously. This idea was developed by Conley and Maloney (1995, 2009), who recognized that reforms imply almost by definition altering of underlying parameters of an economy, the effect of which will be precisely known only with the passage of time. This source of uncertainty could have significant implications for the sequencing of liberalization programs. [1]

In the same line with this discussion, several theories have been developed on the sequencing of capital account liberalization. Firstly, by evoking the argument of the lack of credibility and its role on intertemporal distorsions, Calvo(1987, 1989) suggests that capital account should not be liberalized before agents have sufficient degree of confidence in the sustainability of the trade liberalization program; and that lack of crebility also affects speed of reform in that sense that it leads to shorter liberalization periods.

Secondly, most of economists recommended that the liberalization of capital account should

[1] In that sense, because of the uncertainty intrinsic to the transition process itself, reforms may have undesirable consequences in the short run even if government policy is consistent and credible.

be placed at the end of the process, reasoning that otherwise there would be danger that funds flowing in would be misdirected to sectors that were not the most productive, that the inflow might be intermediated by unsound banks tempted to "gamble for resurrection" or both. Reisen and Fischer (1994) advocate the same sequence but their justification is related to the industrial policy strategy of countries. According to them, being given the close link between capital controls and industrial policy (which is often implemented through government credit allocation), countries are led to maintain capital account control, and as they move from and early to advanced stage of development, the industrial policy rationale for capital controls gradually fades away. Building on this theory, Eastern European reform countries have been advised to concentrate on achieving current account convertibility and treat capital account convertibility as a luxury to be postponed until the completion of reconstruction (Bergsten and Williamson 1990).

Contrary to Calvo, Edwards (1989) advocates a sequencing "rule" based upon the intratemporal effects of reforms. He proposed a principle which states that, with other things given, the reform of those markets with large negative intratemporal indirect effect should take place towards the end of a reform sequence. For example, under the assumptions of substitutability and relative factor intensities, it would be more prudent to postpone the liberalization of the trade sector until the services markets have already been reformed.

If the literature abounds with theories on the sequencing of reforms, force is to note that very few studies tried to test the effectiveness of a sequence compared to another. The idea of the relative effectiveness of a sequence of markets distortions removing is not easy to conceptualize. If we begin with a benchmark of complete markets, which provides an Pareto optimal allocation of resource in the economy, Hard (1975) indicates that it would be unreasonnable to expect an equilibrium allocation to be fully Pareto optimal in an economy where certain markets are missing. The most that we can hope for is that an equilibrium will be constrained Pareto optimal, that is, Pareto optimal relative to the set of allocations that can be achieved through the existing market structure. In addtion, investigating the consequence of opening a new market, Hard(1975) arrives to the conclusion that if we start off in a situation where markets are incomplete, opening new markets may make thing worse rather than better and that when markets are incomplete, an equilibrium may be Pareto-dominated by another allocation which can be achieved using the

same markets. This paper tries fill in the gap of reforms' literature by responding to the following question: "observing the experience of two countries which followed different paths of financial reforms, how can we assess the impact of this difference on their economic welfare levels?"

This question raises three conceptual and methodological issues. The first is that if the countries show different paths of reforms, this is probably due to the difference in constraints to which they face up to when they make their policy choices. The most known constraint is the classical monetary trilemma which is built on the Mundell-Fleming model of an open economy under capital mobility (Mundell, 1963). The monetary trilemma states that (1) a fixed exchange rate, (2) capital mobility and (3) national monetary policy cannot be achieved at the same time and that one policy objective has to be given. As an illustration, under capital mobility and national monetary, fixed exchange rates will invariably break down (Obstfeld et al. 2005).

The second is related to the representation of the reforms trajectory and the distance between them. In fact, being given that we observe two multi-dimensional trajectories (or the path) of reforms, how can we compute the degree of similarity between these trajectories?

The third challenge is one of the most accurate question in comparative cases analysis. The examination of the nature of the relationship between an outcome path and the sequence of "market failures" removing supposes the specification of a relevant counterfactual experience.

This paper uses an innovative methodology, namely, Optimal Matching sequence analysis developed in biology for DNA sequence analysis to build a metric for sequences similarity and thus, compares different trajectories of financial reforms using several benchmarks. Secondly, it characterizes the trajectories of financial reforms while emphasizing the role of monetary constraints (Mundell trilemma) and finally, it proposes a relevant framework for the assessment the impact of trajectory differences on GDP per capita growth. Using a sample of 91 countries observed over 33 years, we find some interesting results. Firstly, empirical results suggest an important heterogeneity in the financial reforms sequence patterns. Secondly, using rank correlation tests, we find that GDP per capita growth is positively and significantly correlated with the sequence of financial reforms. Thirdly, we find that our methodology is sensible to the "normalization" techniques (definition of substitution costs matrix). Finally, we use synthetic counterfactual method (using Korea as benchmark) proposed by Abadie et al. (2004, 2010) and random effects estimations to confirm the results found with rank correlation tests .

In what follows, we shall firstly present the methodology used in this paper for the construction of sequences similarity; secondly, we shall describe the data; then, we shall show the empirical results; and we shall conclude.

2 Methodology

Two approaches about the treatment of sequence exist. First, we have stage theories which rely upon a step-by-step representation of sequence format and focus on internal inter-dependencies in sequences. These aim to find a simple stochastic generator that effectively fits an entire sequence. It may involve autoregression, moving averages, or both in combination, and may reach varying depths into the past. The basic idea of time series analysis is to write a model that is presumably causal. The second conception of sequence involves much more contingency and accident than do stage theories. In this kind of sequence analysis, sequences are treated as whole units and the central issue is nearly always whether there are patterns among the sequences, either over the whole sequences or within parts of them. The main assumption is that sequences here are often more subject to influence by other sequences or by marginal conditions(See Abbott and Forrest(1986) and Abbott, 1990 and 1995). The methodology adopted in this paper is a mix of these two approaches.

2.1 General framework of sequence analysis

We construct a set of sequence variables which allow us to account for the manner in which reforms are implemented over time. Suppose that we have k reform areas: $k \in [1, K]$; that the number of periods and the number of countries in our sample are respectively denoted by T and N. Let ΔR_{kjT} be the effort of reforms in the financial area k in the country j between t and t-1. We define parametrically a vector S_{jt}^{k} which identifies the date at which the first reform effort occured in the country j for the reform area k as follows :

$$S_{jtk} = \begin{cases} t_k \quad if \ \ \Delta R_{kjt} > 0 \ \ \& \ \ t_k < t_k^{'} \ \ When \ \ \Delta R_{kjt} > 0 \ \ \& \ \ \Delta R_{kjt'} > 0 \\ \qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad j = 1, ..., N. \\ 0 \qquad\qquad\qquad\qquad \text{Otherwise} \end{cases} \tag{1}$$

For a given country j, we can now define a $(1 \times m)$ ($m \leq K$) vector S_j which identifies the dates of first reform effort in all the financial areas considered in our sample :

$$S_j = (S_{jt1}, S_{jt2}, ..., S_{jtk}, ..., S_{jtm}) \quad if \quad S_{jtk} \neq 0 \quad , \quad m \leq K \ ; \quad j = 1, ..., N. \tag{2}$$

S_j becomes a sequence variable if we define an order function f which rearranges S_j such as the financial area with the earlier effort of reforms appears first in the vector of dates. For example, our sequence variable, denoted S_j^r, can be characterized as follows:

$$S_j^r = f\left(S_j\right) = (S_{jt2}, S_{jt3}, ...S_{jt1}, ..., S_{jtm}) \quad with \quad t_i < t_k \quad ,, \quad m \leq K \ ; \quad j = 1, ..., N. \tag{3}$$

By defining our sequence variable in such way, we implicitly assume that liberalization efforts in each financial reforms area occurred at different dates in time. Our aim in this paper is to account for the “signal effect” of reform. Indeed, as the commitments of government are often subject to a credibility issue (due to incomplete or asymmetric information), the private sector decision-makers may not be able to tell how serious the government is about the reform process(Rodrik, 1989). Rodrik, suggests that the rate at which the reform is introduced may serve to convey the government’s future intentions, and hence act as a signal of its “type”. He concludes that achieving credibility will always require a larger policy reform than would have been dictated in the absence of credibility problem. In this study, we think that the signaling effect of the first reform’s effort is similary, or even more, important than the signaling effect of large reform’s effort.

2.2 Optimal matching of sequence approach: The metric of sequences

Our idea is to consider sequences as whole units, then to define a benchmark sequence and finally, to use optimal matching of sequences (OM) to find a continuous measure of distance between each sequence and the benchmark sequence. The basic idea of OM is to build up the best alignment by using optimal alignments of smaller subsequences. OM generally works by defining algebras that permit the creation of metric distance between sequences. This method was originally used in biology for research on DNA. It uses the Needleman-Wunsch algorithm to find the alignment between two sequences that have the lowest Levenshtein distance[1]. The Levenshtein distance basically counts the number of operations needed to transform one string into another (Levenshtein,1966).

Concretely, in order to illustrate the optimal matching sequence methodology, let us define two vectors R and C that contain two different sequences of arbitrary lengths m and n. There is one column for each character in sequence C, and one row for each character in sequence R.

Figure 1: Substitution cost representation

R	a	b	c	d	e	f	g
C	c	f	b	d	e	a	g
Substitution Cost	s	s	s	0	0	s	0

[2]Author

Figure 1 shows that the sequences R and C are different in their first, second, third and sixth terms. s_{ij} is the substitution cost between the elements that are found in the sequence at positions i and j respectively. The substitution cost is the number of operations necessary to align C and R. In our case, three substitutions operations are necessary if we want to align C on R : S(a,c), S(f,b) and S(a, f). In practice, the construction of the distance between sequences necessitates three kinds of operations: deletion, insertion and substitution. However, there is a close link between substitution, deletion and insertion operations. Indeed, each substitution can be seen as a combination of one insertion and one deletion (i.e. an insertion in one sequence,

[1]The main advantage of the Needleman-Wunsch algorithm is that it works in the same way regardless of the length or complexity of sequences, and guarantees to find the best alignment. In addition, it is appropriate for finding the best alignment of two sequences which are (i) of the similar length; (ii) similar across their entire lengths, whereas event history analysis is limited to 1st order Markov processes, sequence analysis can capture higher order Markov chains.

followed by a deletion in the other).[3]

In a more general case, to compare the sequences R and C the Needleman-Wunsch algorithm constructs a $(m+1)\times(n+1)$ Lenvenshtein matrix L[4]. The value of each cell $L_{i,j}$ $(i = 2,,m \;\; ; \;\; j = 2,,n)$ is computed using a recursion based on the principle of optimality:

$$L_{i,j} = Min\left(L_{i-1,j-1} + S\left(R_i, C_j\right), L_{i-1,j} + d, L_{i,j-1} + d\right) \tag{4}$$

Where d will refer to as the "insertion-deletion" cost (or "indel-cost") and $S\left(R_i, C_j\right)$ is the substitution cost between the elements that are found in the sequences at positions i and j respectively. For every comparison of items in two sequences, the optimal sequence matching algorithm has search for the appropriate substitution cost in the substitution cost matrix(See Apprendix Table 8 for substitution costs matrix specification). The distance between sequences depends on the number of insertions and on the value of d. The substitution and indel costs have double role in the application of OM. On the one hand, they are terms in the definition of the distance measure; on the other hand, they play a role in the selection of the optimal alignment. In general, substitution costs should decline as elements of sequences become more similar. Some authors (Rohwer and Potter, 2005) propose that the less frequent transition would be more costly than more frequent ones.

Secondly, if sequences of different length are used, the distance measure will be heavily influenced by the disparity in the sequence length because the potential distance between a short and a long sequence is higher than for those of equal length. To avoid this problem, the distance measures have to be standardized by dividing the calculated value by the length of either the sequence with the longer distance or the longest sequence in the dataset. When sequences have unequal lengths and the period of time considered is not too wide in comparison with the unit of analysis, it is not possible to use time-varying substitution costs derived from transition matrices. In such a case, Lesnard(1996) proposes to calculate a single transition matrix which will retain some of the structuration of the underlying time scale. [5]

[3]It is therefore possible to establish a relation between the indel cost and the substitution cost. If the position of an element within a sequence is important, one should define the indel cost to be at least half as much the highest substitution cost.

[4]The cells of the first row and the first column of L are then filled with: $L_{1,i} = L_{1,i-1} + d \qquad ; i = 1, ..., m$; $L_{j,1} = L_{j-1,1} + d \qquad ; j = 1, ..., n$

[5]Indel operations are particularly useful here and absolutely necessary when sequences do not have all the

2.3 Distance normalization: the choice of substitution costs

2.3.1 Row distance

This approach uses the absolute value of the difference between the numeric values representing the respective elements as substitution cost.

$$S(a,b) = |a_i - b_j| \tag{5}$$

Where a_i and b_j are the position of elements a and b.

2.3.2 Probabilistic approach: Durbin et al. (1998)

We use here the general probabilistic model proposed by Durbin et al. (1998). Considering two events a and b occurring in two sequences at the same time t, we define a transition matrix describing trajectories between all the different states between two dates. This matrix is a synthetic representation of individual sequences at a certain moment and, when the sequences have the same length, it could be characterized by $P\left(X_t = a | X_{t-1} = b\right)$ and $P\left(X_t = b | X_{t-1} = a\right)$, which are a series of probabilies describing the transition between a and b considered between dates t-1 and t (Where X_t is a random variable describing the occurence of the t^{th} episode of a sequence).

The rule in the probabilistic approach is that "the higher the transitions between the states a and b and between t-1 and t (with an upper bound of 2) are, the lower is the substitution cost between the two events a and b at t (with a lower bound of 0)". Indeed, high transitions mean that a lot of changes between these two states have just occurred and/or are about to occur, in other words that these states are statistically close. On the contrary, low transitions mean that these two states are from a probabilistic viewpoint very dissimilar. Thus, substitution costs depend on time and are derived from the transitions observed in the sample studied[6].

We adapt this Markovian approach to take into account only the order of financial reforms implementation in the transition matrix.

same length as they can help to re-synchronize the different sequences. But they can also increase their desynchronization.

[6]It is possible to use only substitution operations with such costs when sequences have equal length.

- Mean probability distance

This approach consists in calculating a symmetric substitution cost matrix based on the mean of transition probabilities in the data between every two neighboring elements in the sequences. The substitution costs between elements a and b are defined by:

$$S(a,b) = S(b,a) = \begin{cases} 2 - p\left(X_t = a, X_{t-1} = b\right) - p\left(X_t = b, X_{t-1} = a\right) & if \quad a \neq b \\ 0 & \text{Otherwise} \end{cases} \tag{6}$$

- Minimum and Maximum probability distances

This approach consists in calculating a symmetric substitution cost matrix based on the minimum (maximum) of transition probabilities (p) in the data between every two neighboring elements in the sequences. The substitution costs between elements a and b are defined by:

$$S(a,b) = S(b,a) = \begin{cases} Min\left[1 - p\left(X_t = a, X_{t-1} = b\right), 1 - p\left(X_t = b, X_{t-1} = a\right)\right] * 2 & if \quad a \neq b \\ 0 & \text{Otherwise} \end{cases} \tag{7}$$

3 Data and Empirical results

3.1 Data

We use a sample of 91 countries observed over the period from 1973 to 2004. This sample is constituted by 22 Advanced countries, 14 Sub Sahara African countries, 13 Emerging Asia countries, 18 transition countries, 17 Latin America countries and 7 Middle East and North African countries.

3.1.1 Financial reforms

All financial reforms variables are provided by the New database of financial reforms (Abiad et al.(2008)).

- State owned banks privatization

This index measures whether state-owned banks exit or state-owned banks do not consist of any significant portion of banks. The policy is measured on a four point scale from 0 to 3.

- Elimination of interest rate controls

This index measures whether deposit and lending rates are determined by the central bank or not. The policy is measured on a four point scale from 0 to 3.

- Prudential regulations and supervision of the banking sector

This variable is computed from the responses of the following questions: 1. Does a country adopt risk-based capital adequacy ratios based on the Basle I capital accord? 2. Is the banking supervisory agency independent from the executive's influence and does it have sufficient legal power? 3. Are certain financial institutions exempt from supervisory oversight? 4. How effective are on-site and off-site examinations of banks? The policy is measured on a six point scale from 0 to 6

- Elimination of credit controls and reserve requirements

This index measures whether reserve requirement are restrictive, if there are minimum amounts of credit that must be channeled to certain sector and if there are any credits supplied to certain sectors at subsidized rates. The policy is measured on a four point scale from 0 to 3.

- Capital account liberalization

This index measures whether the exchange rate system is unified and if a country has restrictions on capital inflows and outflows. The policy is measured on a four point scale from 0 to 3.

- Elimination of entry barrier in banking sector

This index measures whether the government allows foreign banks to enter into a domestic market, the government allow the entry of new domestic banks or have they eased branching restrictions; the government allows banks to engage in a wider range of activities. The policy is measured on a four point scale from 0 to 3

- Securities markets

This index measures whether the security markets are developed and if a country's security market is open to foreign investors. The policy is measured on a four point scale from 0 to 3

3.1.2 Other variables

- Monetary independence (MI)

The extent of monetary independence is measured as the reciprocal of the correlation (Corr) of the annual interest rates between the home country and the base country. Money market rates are used. The index for the extent of monetary independence is defined as:

$$MI_{ij} = \frac{1 - (Corr\,(i_i, i_j) - (-1))}{1 - (-1)} \tag{8}$$

Where i refers to home countries and j to the base country. The base country is defined as the country that a home country's monetary policy is most closely linked with as in Aizenmam et al. (2010) and Shambaugh (2004). These countries are Australia, Belgium, France, Germany, India, Malaysia, South Africa, the United Kingdom, and the US. By construction, the maximum and minimum values are 1 and 0, respectively. Higher values of the index mean more monetary policy independence.

- Exchange rate stability (ERS)

To measure exchange rate stability, standard deviations (σ) of the annual exchange rate (e) between the home country and the base country are calculated and included in the following formula to normalize the index between zero and one:

$$ERS_{ij} = \frac{0.01}{0.01 + \sigma\,(\Delta\,(loge_{ij}))} \tag{9}$$

Higher values of this index indicate more stable movement of the exchange rate against the currency of the base country.

- International reserves over GDP

- Financial integration de jure measure (KAOPEN)

KAOPEN is based on information regarding restrictions in the IMFs Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER). Specifically, KAOPEN is the first standardized principal component of the variables that indicate the presence of multiple exchange rates, restrictions on current account transactions, on capital account transactions, and the requirement of the surrender of export proceeds. The Chinn-Ito index is normalized between zero and one. Higher values of this index indicate that a country is more open to cross-border capital transactions.

3.2 Descriptive statistics and Sequence patterns

3.2.1 Financial reforms sequence characterization

A trajectory of financial reforms implementation could be characterized by its length, namely, the number of phases (or reforms) which compose it, by the duration of time which separate each phase in sequence(status quo) and finally, by the order in which each element appears in the time (namely its composition).

- **The composition of financial reforms trajectories**

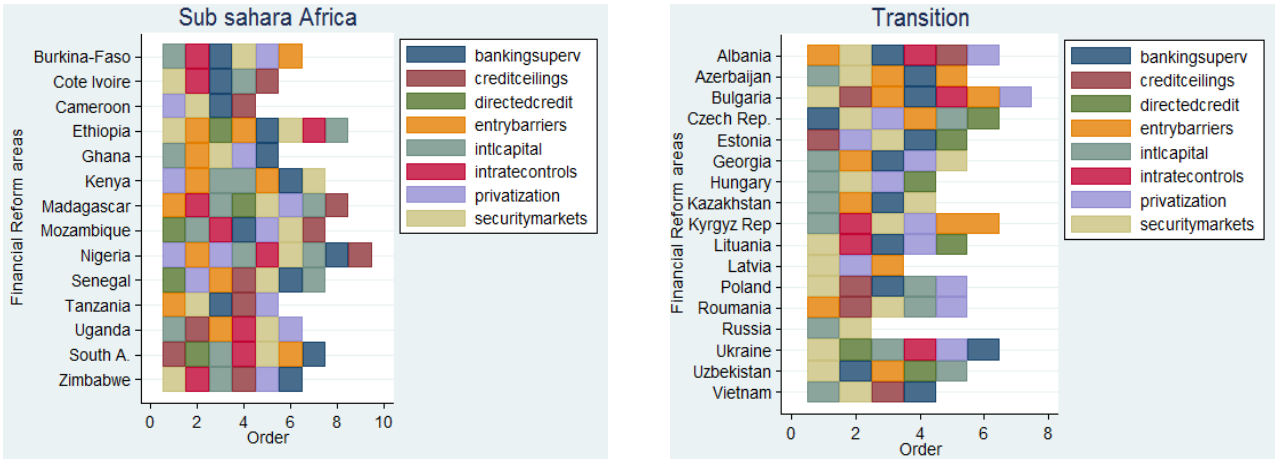
Let us begin by describing the regional composition of financial reforms paths. A closer look at the characteristics of our sample allows us to note some interesting patterns. A first factor which characterizes a trajectory of financial reforms adoption is the order in which different financial reforms appear in time. Figure 2 and Figure 3. illustrate the timing of financial reforms adoption for four groups of countries. As we can see, the timing of financial reforms adoption in SSA countries is mainly characterized by the implementation of securities markets at the end of the reform process[7]. In Transition countries group, most of governments have privatized the state owned banks at the end of the financial reform process. At the same time, we can note that the capital account opening and the extension of security markets seem to have been implemented at the beginning of financial reform process. The timing of reforms in LAC countries shows the most chaotic pattern. Nevertheless, it seems that in 80 % of LAC countries, the adoption of

[7]Except for Nigeria (1988), Cote d'Ivoire (1976) and Zimbabwe (1979), in most of cases the first reform effort in securities markets occured after 1990

Basel I banking sector supervision and regulation standards occured at the end of the reform process.

For Emerging Asia countries, the timing of financial reforms adoption has been characterized by the the adoption of Basel I banking sector supervsion and regulation standards and the privatization of state owned banks at the end of reforms process and the reduction of entry barriers at the beginning of reform process. Stiglitz and Marilou (1996) highlight six ways in which financial repression in these countries seems to have differed from repression found in other developing countries. Amongst other things, the fact that most directed credit was funneled to private-sector enterprises; that performance criteria are used to guide directed credit programs and that limitations on the use of outright subsidies are put in place.

Figure 2: Timing of financial reforms implementation: SSA and Transition

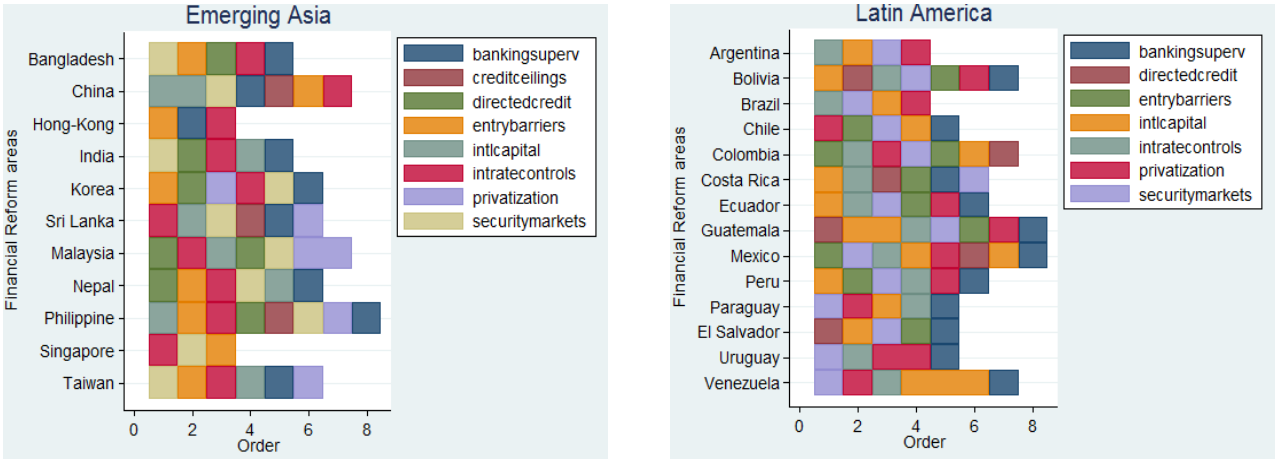


[8]Author calculations

- **The length of financial reforms trajectories**

The trajectory of financial reforms implementation could also be characterized by its length, namely, the number of phases (or reforms) which compose it. According to Table 1. it seems that the average number of reforms is roughly equal to 6 in LAC and Emerging Asia countries. Which means that on average six of our eight financial reforms areas have been implemented at least one time in these countries. Transition and SSA countries have respectively the lowest and the highest length of financial reforms implementation sequence. This result reflects the fact

Figure 3: Timing of financial reforms implementation: Emerging Asia and Latin America



[9]Author calculations

that transition countries have a relatively recent existence[10] and that, in Sub-Sahara countries, reforms were set up tardily.

Table 1: Average number of financial reforms in reforms path

	SSA	MENA	Emerg. Asia	Transition	LAC
Length	6.711	5.4	6.032	5.169	6.205

[11]Author calculations

- **Characterization of status quo duration**

In this subsection, we stress the importance of the duration between each reform adoption(status quo) and characterize it. In fact, the choice to postpone the adoption of a new reform or to implement it now may depend on the relation between the system of reforms at date t and the new reform. In the case where the new reform is complementary in Edgeworth sense[12] with the existent ones, an earlier implementation of the new reform could increase the outcome of reforms. The status quo may also be associated to the time need for the preparation, drafting, and implementation of reform[13].

[10]Most of them are ex-soviet countries which begin to exist after 1990.

[12]For Edgeworth complementarity is a matter of order "doing more of one thing increases the returns to doing more of another"

[13]Fischer and Reisen (1994) noted that tax reforms in developing countries have often failed because the period allowed for preparation and implementation was too short. For example Indonesia's tax reform, has been a

Table 2. represents a conditional status quo matrix $(a_{ij})_{1\leq i,j\leq 8}$ which identifies the average duration between the adoption of reform i and when the reform j has been adopted. Where $a_{ij} = (t_i - t_j) \,|\, (t_i > t_j)$.

The first remark from Table 2. is that the matrix of conditional status quo is not symmetric. Which means that once the reform x has been implemented, it runs out b years before reform y is implemented and that if the reform y is implemented, the time running out before reform x is implemented is different from b years.

Table 2: Conditional status quo: Whole sample

$\longrightarrow j$	Banking	credit	Directed	Entry	Capital acc.	Privatization	Int. rate	Securities
$\downarrow i$	superv.	ceilings	credit	barriers			deregula.	markets
Banking superv.		2.125	5.333	6	7.846	8.4	3.75	4.058
credit ceilings	4		3	9	2	-	5	7
Directed credit	3.4	1		3.8	3.64	1.75	4.333	3.6
Entry barriers	2.4	1.666	6.285		1.166	2.909	2.714	3.714
Capital acc.	4	1.4	2.888	2.090		3.133	2.444	3.666
Privatization	4.2	2	4	1	2.5		1.833	2.933
Int. rate	3.545	3.5	3.333	3.166	6.692	5.666		4.533
Securities markets	3.059	4.285	2.666	2.866	3.625	4.625	2.578	

[14]Author calculations

Secondly, this table shows an important heterogeneity in the conditional status quo duration among different reform areas. For example, when a country adopts privatization measures in its banking sector at t, the time needed before this country removes the entry barriers in banking sector is on average of three (≈ 2.909) years. Conversely, when this country first has removed the entry barriers in the banking sector, the privatization occured one year after. The most important duration of status quo is observed when the banking supervision and regulation measures are adopted after the capital account liberalization ($\approx$ 7.846 years) or after states owned banks have been privatized($\approx$ 8.4years). Our results are quite different from those of Williamson and Mahar (1998), which, using a limited sample of 51 countries observed over the period 1973-1996, noticed that the introduction of domestic financial liberalization occurs at least two years prior to deregulation. They also remark that the liberalization of entry into banking sector (for domestic

rare exception of success. Indeed, in Indonesia the tax reform plan allowed a two-year period for the necessary administrative and technical changes before implementation.

and foreign banks) occurs at least two years prior to deregulation and that the reduction of government ownership of banking sector to less than 40% occurs at least two years prior to deregulation.

3.2.2 Monetary constraints and financial reforms sequences

The divergent paths of reforms observed in the different groups of countries could reflect an heterogeneity in the distributions of macroeconomic and policy constraints to which countries are subjected. In this subsection, we choose to focus on the Mundell monetary trilemma which states that (1) a fixed exchange rate, (2) capital mobility and (3) national monetary policy cannot be achieved at the same time and thus, that one policy objective has to be given. As an illustration, under capital mobility and national monetary autonomy, fixed exchange rates will invariably break down. Given this framework, we expect that countries which exhibit a higher level of monetary independence and a lower level of capital account are more prone to control their interest rates and to impose some restrictions on credit markets (or in the reverse sense)[15].

The Diamond charts shown in Figure 4 and Figure 5 are useful for tracing the changing patterns of the trilemma configurations. Each of the charts shows the levels of the three policy goals as well as international reserves (as a ratio to GDP) with the origin normalized[16] so as to represent zero monetary independence, pure float, zero international reserves, and financial autarky.

The first remark is that in spite of the collapse of the Bretton Woods regime after 1973 which led to a shift of the ground under the arguments about reserve holding, Figures 4. and 5. do not stress a reduction in the level of reserves holding in the decade 1981-1990 in comparison with the period 1973-1980. Indeed, even if a new resolution of the trilemma emerged with capital mobility and floating exchange rates after the collapse, it was unclear what this move meant for reserves holding.[17] As noted by Obstfeld et. al (2008) "the exigencies of the 1980s debt crisis

[15]Moreover, to prevent their currency to be attacked, namely to maintain the stability of their exchange rate, monetary authorities of these countries could use hugely measures such as a increase in domestic interest rates.

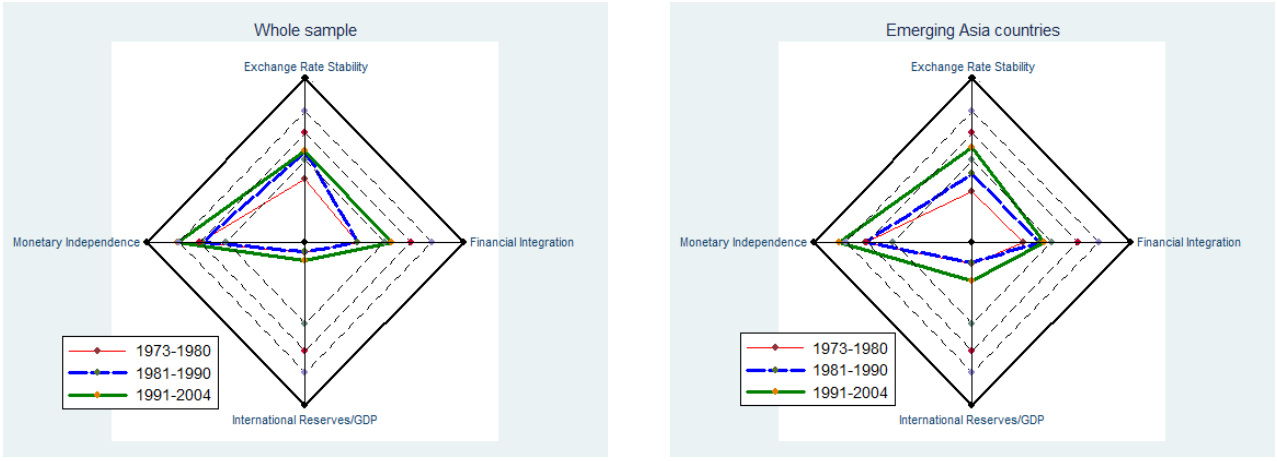
[16]The normalization formula used is the following: $\frac{X_t^{Max} - X_{it}}{X_t^{Max} - X_t^{Min}}$.

[17]Indeed, on the one hand, a truly floating regime needs no reserves and a liberalized financial account would minimize the need for reserve change to absorb a given set of balance-of-payments shocks; on the other hand, governments are far from indifferent to the exchange rate's level and a liberalized financial account might in and of itself generate more balance-of-payments instability, possibly augmenting reserve needs. As if to support an array of confounding theoretical arguments, global international reserves did not decline noticeably relative to

did lead to a decline in the growth rate of developing-country reserves during the 1980s".

For the period 1991-2004, "Diamond charts" indicate an important increase international reserves held by countries. This increase is mainly due to the new thinking on the role of international reserves in a financially globalized world (after the new wave of rich-to-poor capital flows starting in the 1990s) which justifies the increase in international reserves holding by the need to face currency crises (Obstfeld et. al, 2008)).

Figure 4: Mundell trilemma: Whole sample and Emerging Asia



[18] Author calculations

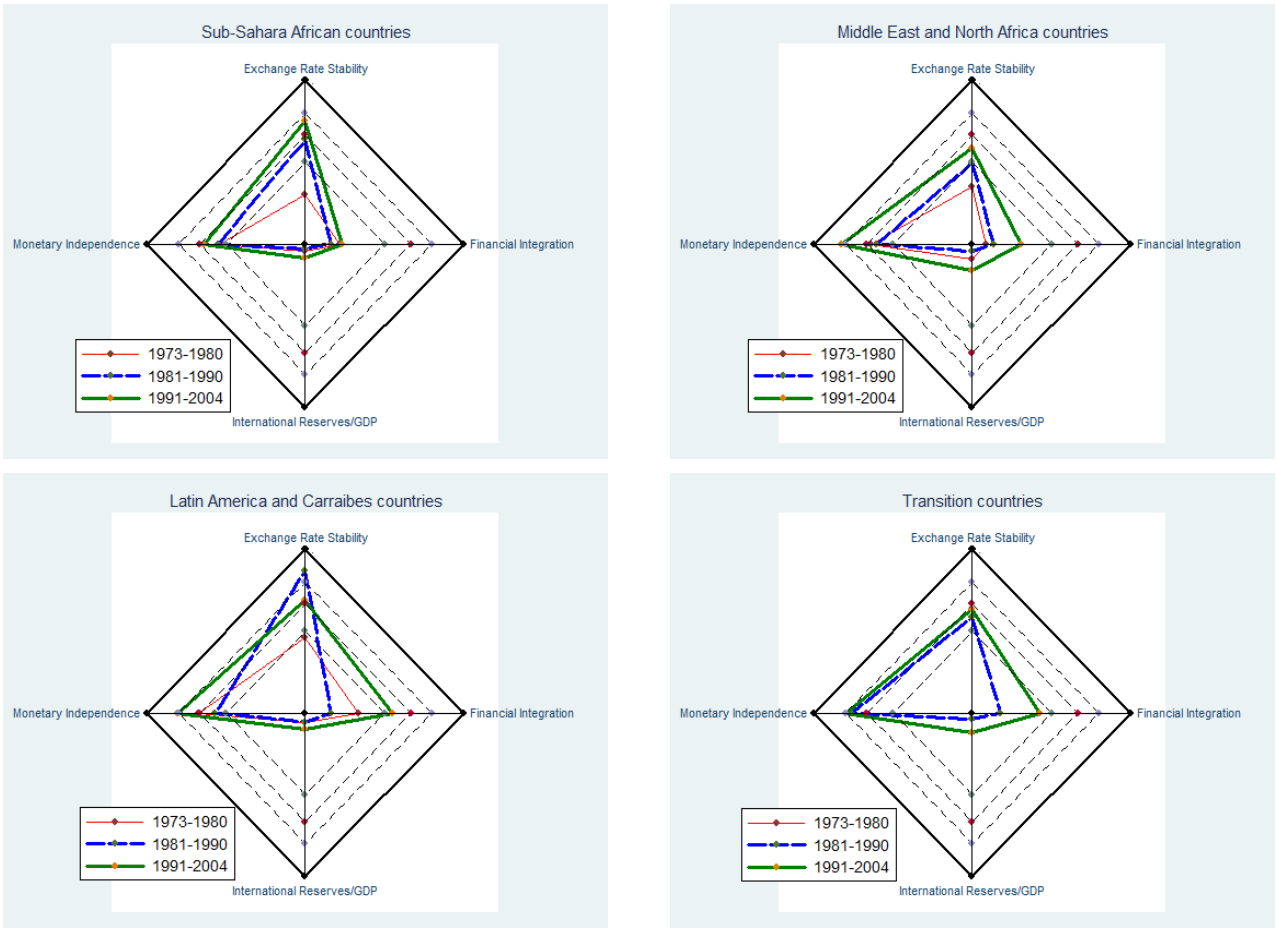
For MENA and SSA developing countries, exchange rate stability has been the most permanently pursued policy throughout the period. Moroever, in contrast to the experience of the emerging market economies (Emerging Asia and LAC), capital account liberalization is not proceeding rapidly for those countries. This pattern of results suggests that developing countries may have been trying to cling to moderate levels of both monetary independence and financial openness while maintaining higher levels of exchange rate stability (leaning against the trilemma in other words) which coincides with the period when some of these economies started holding sizable international reserves, potentially to buffer the trade-off arising from the trilemma.

Asian emerging market countries have opted for a more balanced combination of the three policy goals, which can make one suspects it is the large international reserve accumulation that may have allowed this group of countries to achieve such a trilemma configuration, contrary to

output after shift to floating exchange rates (Obstfeld et. al,2008).

LAC countries which have moved toward exchange rate flexibility have rapidly increased financial openness.

Figure 5: Mundell trilemma: Regional patterns



[19] Author calculations

4 Empirical results : Sequences and Economic performances

Our main aim in this paper is to study the link between the trajectory of the financial reforms adoption and GDP per capita growth. The empirical investigation of this link requires the definition of a benchmark sequence in comparison with which we will assess the impact of the other sequences of our sample. We take up this first challenge by choosing three kinds of benchmark. The first benchmark is constructed empirically using several normalization rules; the second is

identified as the sequence(s) of countries (the country) which perform(s) better in terms of our outcome variable. And finally, the construction of the third benchmark relies upon the definition of an hypothetical sequence according the some recommandations in the literature. The second challenge is that of appropriated computation of our outcome variable. The third challenge consists to assess the link between the path of financial reforms and GDP per capita growth.

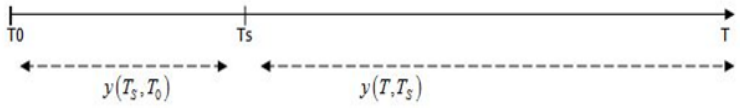
4.1 Economic performances calculation

As our measure of distance between sequences is by definition invariant and unique for each country, it is essential to find an appropriated methodology for the computation of the outcome variable. We propose to calculate the average value of outcome variable after the beginning of sequence (T_s) adjusted for its trend during the pre-sequence period for each country of our sample; and then, we take the difference between this value and the average outcome variable after the beginning of sequence ($T_s^{'}$), adjusted for the trend of outcome during the pre-sequence period for our benchmark country. That is,

$[Y(T,T_s) - Y(T_s,T_0)] - \left[Y^b\left(T^{'},T_s^{'}\right) - Y^b\left(T_s^{'},T_0^{'}\right)\right]$.

The main issue in this formula is the computation of $Y(T,T_s)$ and $Y^b\left(T^{'},T_s^{'}\right)$. Should we give the same weight to the status quo's year outcomes and to the reform year's outcomes? It is important to notice that a reform strategy includes both financial reform efforts and the status quo periods between each reform effort.

Figure 6: Timeline for outcome calculation



- If we allow the same weight $(T - T_s)^{-1}$ to growth during the reform effort's year and to growth during status quo's years, thus for each reform k, the utilization of a simple average during the period is suited: $Y(T,T_s) = \frac{1}{T-T_s}\sum_{t=T_s}^{T} Y(t)$.
- If we assume that the GDP per capita growth follows a different path after each reform effort, namely after each phase of sequence, then we must allow a specific weight to each sub-period of the sequence by $m^{-1}(T^k - T_s^k)^{-1}$. The average GDP per capita growth after

the sequence beginning is given by: $Y(T,T_s) = \frac{1}{m}\sum_{k=1}^{K}\left[\frac{1}{T^k - T_s^k}\sum_{t=T_s^k}^{T^k} Y^k(t)\right]$. Where m is the maximum number of reforms; T_s^k the date of adoption of reform k in the sequence and T^k the date identifying the end of status quo period after the reform k.

- Finally, if we consider that the adoption of each step of reform sequence involves an inrease in GDP per capita level which is different from the dynamic of growth during the underlying status quo period before the adoption of the next reform. In this case, we can choose to weight the reform adoption year by $(2m)^{-1}$ and the status quo year by $(2m)^{-1}(T^k - T_s^k)^{-1}$ and thus, $Y(T,T_s) = \frac{1}{m}\sum_{k=1}^{K}\frac{1}{2}\left(Y^k(T_s) + \left[\frac{1}{T^k - T_s^k}\sum_{t=T_s^k+1}^{T^k} Y^k(t)\right]\right)$

Figure 10. shown in Appendix plots the distributions of average growth level after the beginning financial sequence for the first two formula of outcome computation. It indicates a high sensitivity of the rank of countries when we use the $m^{-1}(T^k - T_s^k)^{-1}$ rather than the weight $(T - T_s)^{-1}$. Particularly, distribution of growth is less dispersed.

Since the distribution of average growth in case 2 and 3 are similar, we will use the first specification of $Y(T,T_s)$ and the second one.

4.2 Strategy 1: Distance from empirical benchmark sequence and GDP per capita growth

The first strategy adopted in our sequence comparison analysis is based upon the empirical characteristics of the sample. Fisrtly, we use the longest sequence, in other words, we choose the country (countries) which has (have) implemented all the m reforms as our benchmark. Secondly, we use several substitution costs matrix and compute respectively: subcost mean distance, raw distance, min distance and max distance.

Let us define $X_k^* = (x_1^*, x_2^*, ..., x_m^*)$ as the benchmark sequence and X=$(x_1, x_2, ..., x_m)$ any other sequence implemented in any country in our sample and $(Y_1, Y_2, ...Y_k^*...Y_n,)$ and $(D_1, D_2, ...D_k^*...D_n)$ be respectively the level of outcome reached by the N countries in the sample and the set of the distance of their sequences from the benchmark sequence X_k^*.

The next step consists in defining the Spearman rank correlation coefficient,which provides an assessment of how well the relationship between the rank of each observation on respectively

the distance from the benchmark D_i and its rank on outcome variable y_i, can be described using a monotonic function. If the Spearman correlation coefficient between is negative (and above -1) and statistically significant then we can conclude that the closer the countries are to the benchmark sequence, the higher is their outcome.

Table 3. suggests that for SSA and Emerging Asia countries there is an unambiguous negative correlation between GDP per capita growth and the similarity between any sequence and our empirical sequence. The second remark is that for the other groups of countries the results are highly influenced by the choice of substitution matrix, namely, the normalization used in sequences similarity construction. Thus, for Transition countries, it seems that there is a negative and significant correlation between growth and financial reforms trajectory only when we do not use normalized distance or when we use raw normalized distance.

Table 3: Spearman rank correlation between distance from an empirical sequence and GDP per capita growth

Sub-cost Specification	Whole	SSA	MENA	LAC	Emerging Asia	Transition
	Spearman	Spearman	Spearman	Spearman	Spearman	Spearman
Longer distance	-0.0833*	-0.1933*	0.6151***	0.1142	-0.8285***	-0.0982
None Normalization	-0.1283***	-0.3899***	0.6151***	0.1329	-0.8419***	-0.3123***
Mean distance	-0.0003	-0.2756**	0.1322	0.0254	-0.5873***	0.0392
Raw distance	-0.1064**	-0.4849***	0.6151***	-0.0938	-0.8070***	-0.2986***
Min distance	0.0016	-0.2684**	0.1322	0.0161	-0.6554***	0.0247
Max distance	0.0002	-0.2996***	0.1322	0.0608	-0.4317***	-0.0429

[20]Note: (***), (**) (*) mean respectively significant at 1%, 5% and 10%

4.3 Strategy 2 : Distance from the global and regional "best performance" sequence

In this strategy, we construct a set of economic performance vectors, which include GDP per capita growth. And then, we study the coherence between distances from the sequence of country which performs better in terms of these economic performances areas (or at least in terms of one of these outcome variables).

Concretely, if we define $X_k^* = (x_{1k}^*, x_{2k}^*, ..., x_{mk}^*)$ such as $Argmax\{f(X_k^*) = y^*\}$, $X_i = (x_{1i}, x_{2i}, ..., x_{mi})$ as any other sequence implemented in any country "i" in our sample and

$(Y_1, Y_2, ...Y_k^*...Y_n,)$ and $(D_1, D_2, ...D_k^*...D_n)$ as respectively the vector of outcome level reached by the N countries in our sample minus the level of outcome variable in the benchmark country and the vector of the distance of their sequences from the benchmark sequence Y_k^*; as in the previous strategy, we compute the rank correlation between Y and D.

Using this strategy, Table 4. indicates that only in Emerging Asia, Transition and LAC countries, a closer distance from the regional "best performance" sequence seems to be associated with high GDP per capita growth.

Table 4: Spearman rank correlation between distance from the best performance sequence and growth

Diff (post-pre) sequence growth	Whole:	SSA:	MENA:	Emerg. A :	Transition:	LAC:
Weight: $(T - T_s)^{-1}$	-0.0447	-0.1255	-0.428**	-0.8532***	-0.2338**	-0.1950*

[21]Note: (***), (**) (*) mean respectively significant at 1%, 5% and 10%
[22]**Weight1 benchmark countries**: Whole: Azerbaijan; SSA: Ghana; MENA: Tunisia; Emerging A.: Nepal; Transition: Azerbaijan; LAC: Chile

4.4 Strategy 3: Distance from Fisher and Reisen (1994) sequence (Washington consensus) and GDP per capita growth

In this subsection, instead of conditioning the specification of our benchmark sequence to some economic performances or empirical characteristics of our sample, we try to build some distance from hypothetic sequences recommended in the literature. The main sequence considered here is one of Fischer and Reisen (1994) which inspired the " Washington Consensus" policies package. These authors identify what they called " the best timing" for each capital account liberalization measure, which aims to avoid disruption and ensure that financial opening achieves its ultimate objectives: to raise efficiency and growth without compromissing stability.

According to their sequence, liberalization of foreign direct investment and trade finance should come first. The fiscal consolidation is needed before the capital account is opened up for two reasons. First, government finances and tax efforts need to be sufficiently strong to obviate the need for domestic financial repression, otherwise, implicit and overt taxation of financial intermediation, the substitute for regular tax receipts will breed capital outflows. Second, unless

the government has fiscal control it has to violate Mundell assignment and use monetary policy for internal balance. However to use monetary policy for internal balance requires capital controls to insulate the country from international capital movements. Consequently it losses its monetary autonomy because with a fully open capital account would leave no instruments for stabilization policy if fiscal policy cannot be used flexibly, this will result in higher inflation in the economy.

Moreover, a healthy fiscal position is required to cope with potential bad loan problems in the financial sector, therefore once the fiscal consolidation achieved, the next step in reforms timing is the implementation of measures for improved bank regulation and supervision. After macroeconomic stability is achieved; institutional mechanisms are in place for the domestic financial sector; any bad loan problems are resolved, according to Fischer and Reisen (1994) domestic interest rates can be freed now. At the same time the authorities should take steps to foster deepened securities markets. Indeed, domestic markets in developing markets are too small to absorb shocks through variations in domestic liquidity: liquidity shocks often end up in the central bank as hidden losses. Therefore, full financial opening requires the establishment and deepening of money and securities markets. The failure to establish and deepen domestic money and securities markets is often simply a consequence of ongoing domestic financial repression [23]. The time needed to establish and deepen money markets crucially depends on how quickly domestic financial repression is overcome. Otherwise, while using indirect monetary tools for daily operations, when everything goes well, the monetary authorities of the advanced developing country will typically resort to direct credit rationing and mandated asset transactions to combat capital flight and recession.

Then it is prudent to liberalize capital outflows and complete domestic financial reform. At this point, the entry of foreign banks into the domestic financial system can be permitted and finally, the liberalization process can be completed by opening up to short-term capital inflows.[24]

[23]Deregulation of interest rate, for example, threatens the soundness and safety of banks that have been saddle with nonperforming forming government credit allocation. Interest regulation also inhibits the development of domestic money markets, bond markets, and secondary securities markets (open market operations).

[24]Building on the experience of many countries emphasized which a persistence in the interest rate differential after financial opening and on the microecomic explanations(Microeconomic explanations stress structural impediments in the domestic financial sector: segmented credit markets, oligopolistic structure of the finance industry, interlocking ownership of banks and firms, and overhang of bad loans, as the main causes of the persistence of interest rate differential) of this phenomenum, Fischer and Reisen (1994) concluded that the expected results from their sequence are of three order. On one hand, interest rate convergence will be achieved. Secondly, new external resources will be allocated efficiently. And finally, crises will be less likely.

The results suggest that for the whole sample, Finland is the country which financial reforms sequence is closest to the sequence suggested by the "Washington consensus". Moreover, according to Table 5., it seems that the closer the sequence of a country compared to Finland sequence' is, the more important is its GDP per capita growth. This table also stresses some regional specificities. Indeed, it seems that the rank correlation remains negative and statistical significant only for Emerging Asia and Latin America countries and that, conversely the distance from Fischer and Reisen sequence seems to be associated with a lower growth in SSA countries and seems to be not related to GDP per capita growth in MENA and Transition countries.

Table 5: Rank correlation between distance from Fischer and Reisen (1994) sequence and growth

Diff Growth post-pre sequence	Whole:	SSA:	MENA:	Emerg. A :	Transition:	LAC:
Weight:$(T - T_s)^{-1}$						
Spearman rank corr.	-0.1697***	0.3461***	0.2747	-0.7334***	0.0812	-0.3221***
Kendall rank corr.	-0.1212***	0.2758***	0.2542	-0.6217***	0.0580	-0.2733***

[25]Note: (***), (**) (*) mean respectively significant at 1%, 5% and 10%. Benchmark countries: Whole : Finland; SSA: Senegal, South Africa; MENA: Egypt, Morocco; Emerging A.: China, Hong-Kong, Singapore, Bangladesh; Transition: Georgia, Roumania, Lithuania, Latvia, Uzbekistan; LAC: Chile, Paraguay, El Salvador

4.5 Synthetic counterfactual estimations: The case of South Korea

The bivariate analysis based upon the rank correlations between the distance from a benchmark sequence and the economic performances is useful because it provides an idea on the link between the variables considered. But it relies upon a very strong assumption that nothing other than the difference between financial reforms sequences affects the outcome variable. Thus, it could be misleading if macroeconomic and structural factors other than the sequence of reforms also affect the outcome variable dynamics. In this section, we use the *Synthetic Contol method* proposed by Abadie et al. (2004) and Abadie et al.(2010) to estimate the effect of a given intervention (that is, financial reforms sequence) by comparing the evolution of an aggregate outcome variable for a country or a group of countries affected by that intervention vis-à-vis the evolution of the same aggregate outcome for a synthetic control group.[26] Concretely, it focuses on the construction of

[26]This model extends the traditional linear panel data (difference-in-differences) framework, allowing that the effects of unobserved variables on the outcome vary with time. In addition, it proposes a new method to perform inferential exercises in comparative case studies that produce potentially informative inference regardless of the number of available comparison units and the level of aggregation of the data.

a "synthetic control group" which is similar in all aspects to the benchmark country except in the sequence of reforms adopted. It does so by searching for a weighted combination of other countries chosen to mimic the country affected by the intervention given a set of predictors of the outcome variable. The evolution of the outcome for the synthetic control group is therefore an estimate of the counterfactual of what would have been the behavior of the outcome variable for the affected country if the intervention had happened in the same way as in the control group.

The identification assumption here is that after controling for observed quantifiable characteristics, nothing other than the difference between financial reforms sequences affects the outcome variable.

- **Effect on GDP per capita growth**

We consider Korea as our benchmark country and try to assess the effect of empirical sequence. Indeed, Korea's financial liberalization is often quoted as an exemple of cautious and slow (in terms of its order and speed) liberalization process. As described by Park (1996), the influence of government diminished gradually in financial markets as its industrial policies were not easily separated from financial policies. At the same time, the cautious approach to financial opening was preferred to prevent external factors from creating additional disturbances in the process of domestic financial liberalization. Finally, it is important to note that, despite the slow pace of financial liberalization, Korea's financial market and financial policies have changed greatly since the early 1980s.

The control variables retained here are: initial GDP per capita level, initial GDP per capita growth level, the exchange rate stability index, the financial integration, the monetary independence and financial crises (Debt, currency and banking) variables. We restricted the sample to 62 countries because of missing observations issues. For our treated unit (namely Korea) the first financial reform has been implemented at 1977; however, we choose to set the beginning of sequence at 1980 [27] in order to increase the length of the pre-sequence implementation period(or pretreatment period).

The results are displayed in Table 6. We can see that except for the level of GDP per capita, the average of the other pre-sequence characteristics of actual Korea with that of "synthetic

[27] This date also corresponds to the date identified by Williamson and Mahar (1998) as the beginning of financial reforms process in Korea

Korea" seem to be very close.

Table 6: GDP per capita predictor means

Predictors	Treated	Synthetic
Aggegrate financial reform initial level(1980)	.2380952	.2328095
Aggegrate financial reform final level(2004)	0.714286	0.718381
GDP per cap growth(1976)	8.82045	8.800492
GDP per cap growth(1977)	8.294069	8.281073
GDP per cap	7375.583	7315.294
Exchange rate stability	0.017670	0.017567
KAOPEN	-0.782772	-0.780341
Monetary independence	0.2246286	0.2225918
Debt crisis	0	0
Banking crisis	0	0
Currency crisis	0	0

Figure 7 completes the analysis of predictors' means by representing the evolution of trilemma for our treated unit (namely Korea) and trilemma of the synthetic Korea. If the two kind of countries seem to show similar dynamics for the Monetary independence and the financial integration (in terms of breaks but not in terms of levels),exchange rate stability however reveals diverging patterns. Indeed, we observe a continuous increase in the ERS for Korea over the sample period and a decrease in the level of ERS during the period 1980-1990 followed by a increase of exchange rate stability (ERS) during the period 1990-2004 for our "synthetic Korea". However, according to Table 6., when we consider the average level of exchange rate stability Korea and "synthetic Korea" seems to be very close.

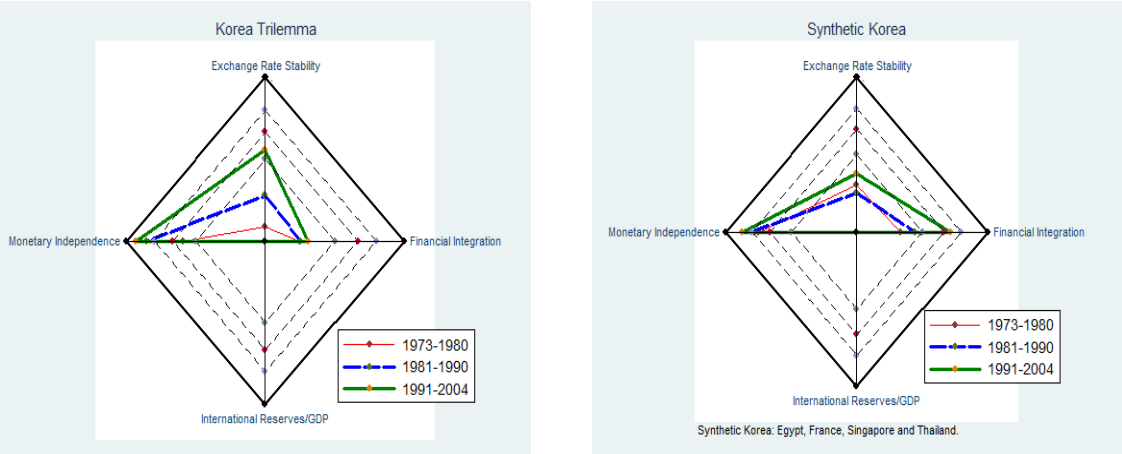
Table 11. (see Appendix) displays the weights of each control state in the synthetic Korea. The weights reported in this table indicate that growth trends in Korea prior the beginning of financial reforms sequence is best reproduced by a combination of Egypt, Thailand, Singapor and France.

Finally, before showing the effect of sequence on the GDP per capita let us make sure that the sequence adopted by Korea[29] and "synthetic Korea" are very different.

Table 7. indicates that whatever the type of normalization used, the sequence of financial reforms adoption in Korea has been very different from that of the "synthetic Korea". This

[29]Korea's sequence: 1. Removing the entry barriers 2. deregulation of directed credit 3. privatization 4. relaxation of interest rate controls 5. security markets extension 6. adoption of banking supervision and regulation standards.

Figure 7: Mundell trilemma: Korea vs. Synthetic Korea



[28]Author calculations

result is very important because it supports our main assumption which is that after controlling for the relevant characteristics of countries, the only difference which remains is the difference between the sequence of financial reforms adopted by Korea and "synthetic Korea".

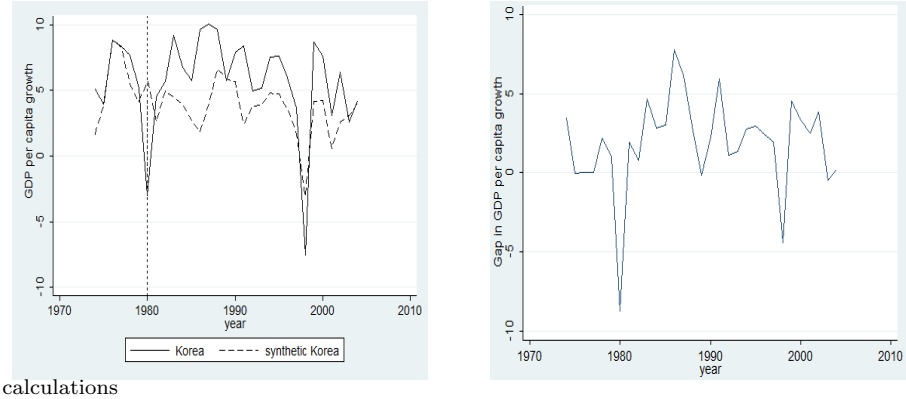
Table 7: Korea vs. "Synthetic Korea": distance from benckmark sequence

Predictors	Treated	Synthetic
None normalization	0.7777	0.6913
Longer distance	1	0.8889
Mean distance	1.1962	0.9488
Raw distance	0.77777	0.6419
Min distance	1.1912	0.9459
Max distance	1.2011	0.9516
Distance from Fischer & Reisen (1994)	1.1111	0.8518

Figure 8. displays GDP per capita growth for Korea and its synthetic counterpart during the period 1974-2004. It indicates that GDP per capita growth in synthetic Korea very closely tracks the trajectory of this variable in Korea for the pre-sequence period.

Figure 8. suggests that the sequence of financial reforms has a large positive effect on GDP per capita growth, and that this effect fluctuates hugely in the time. The most important negative effects coincided with the two majors shocks (the systemic financial crisis in 1997, and the effect of second oil shock in 1979) which hit Korea during our sample period. This result is consistent

Figure 8: GDP per capita Growth trend and Gap: Korea vs Synthetic Korea



[30] Author calculations

with Ranciere, Tornell et. al (2006) results which suggest that financial liberalization enhances GDP per capita growth in the countries but could also increase the probability of financial crises and thus reduce the GDP per capita growth but that the net effect still positive.

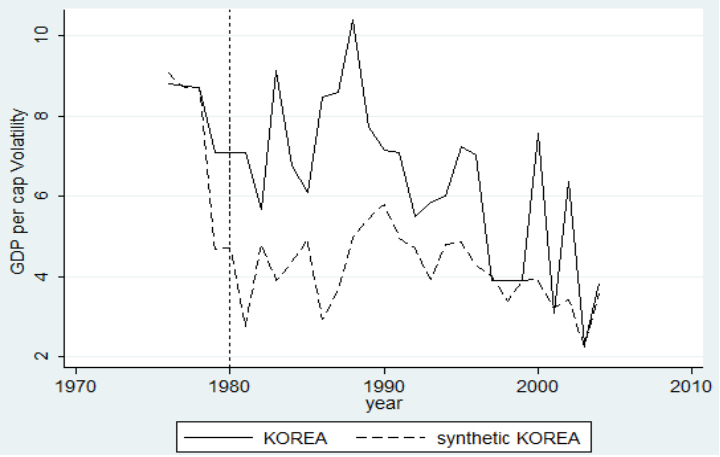
- **Effect of financial reforms sequence on GDP per capita growth Volatility**

As emphasized by several studies (Rancière et al. (2006), Kaminsky and Schmukler (2003)), financial liberalization is often associated with financial instability. As a result, our analysis is incomplete if we do not assess the effect of financial reforms trajectories on GDP per capita growth Volatility. As in the previous sub-section, we compare Korea GDP per capita volatility to synthetic Korea growth volatility. We compute growth volatility as the standard deviation of GDP per capita growth in 4 years rolling windows.

Table 11.(see Appendix) compares characteristics of actual Korea with that of "synthetic Korea" before the beginning of financial reforms implementation. The synthetic Korea is constituted by four countries, namely, Cameroon (weight=0.213), Egypt(weight=0.407), Singapore(weight=0.202) and Thailand(weight=0.179). It indicates that except for the level of GDP per capita, the average of the other predictors of GDP per capita volatility seems to be very close.

By considering these two groups of countries, Figure 9 . shows that GDP per capita volatility has been more important in korea in comparison with synthetic Korea and that the most important difference in episodes of volatility have been observed in 1982, 1988 and 1997. This

Figure 9: GDP per capita Growth Volatility: Korea vs Synthetic Korea



[31]Source: Author

result goes beyond the theory which supports the idea that financial liberalization have a positive direct effect on growth and an adverse effect on growth mainly through financial instability. In fact, it shows that the path of financial reforms followed by countries could affect their GDP per capita growth volatility.

4.6 Extensions

4.6.1 The role of status quo

Is there a logical explanation to the fact that conditional status quo matrix is not symmetric? One way to include the speed of reforms and their sequence is to allow alternative weights to status quo length when we compute the average growth associate with each reform sequence as we have done in section 4.1. If the observed changes in the rank of countries on the distribution of average growth (see figure 10. Appendix) are associated with a change in the extent or in the direction of the correlation between the adjusted growth and the distance from a given benchmark of sequence, then we can conclude that status quo matters. Indeed, regarding the results of subsections 4.2. and 4.3. interesting modifications can be observed in the sign and the extent of rank correlation.

First of all, if the direction of the correlation between the distance from regional (or world) growth "best performance" sequence and the adjusted growth of countries does not fundementally

change, there is a systematic modification in the statistical quality of the relationship between these variables. Indeed, negatively and significantly correlations are observed for the whole sample, the SSA countries and the LAC countries respectively.

Table 8: Rank correlation between distance from the best performance sequence and growth

Diff (post-pre) sequence growth	Whole:	SSA:	MENA:	Emerg. A :	Transition:	LAC:
Weight:$m^{-1}(T^k - T_s^k)^{-1}$	-0.2558***	-0.5792***	0.2414	-0.1782	-0.0301	-0.4486***

[32]Note: (***), (**) (*) mean respectively significant at 1%, 5% and 10%
[33]**Weight2 benchmark countries**: Whole: Latvia SSA: Mozambique; MENA: Egypt; Emerging A.: Singapore; Transition: Latvia; LAC: Chile

Secondly, when Fisher and Reisen (1994) sequence is considered as benchmark, results shown in Table 9. indicate a systematic change in the direction of rank correlation in comparison with the case where all reforms status quo periods are weighted equally (Except for MENA countries).

Table 9: Rank correlation between distance from Fischer and Reisen (1994) sequence and growth

Diff Growth post-pre sequence	Whole:	SSA:	MENA:	Emerg. A :	Transition:	LAC:
Weight:$m^{-1}(T^k - T_s^k)^{-1}$						
Spearman rank corr.	-0.0487	-0.2877***	0.00	0.4373***	-0.5118***	0.058***
Kendall rank corr.	-0.0409	-0.1822***	0.0484	0.3466***	-0.4319***	0.3122***

[34]Note: (***), (**) (*) mean respectively significant at 1%, 5% and 10%. Benchmark countries: Whole : Finland; SSA: Senegal, South Africa; MENA: Egypt, Morocco; Emerging A.: China, Hong-Kong, Singapore, Bangladesh; Transition: Georgia, Roumania, Lithuania, Latvia, Uzbekistan; LAC: Chile, Paraguay, El Salvador

The main implication of these results is that the length of status between each financial reform adoption in the sequence matters. Consequently, it could be judicious to allow different weight to the status length when we compute the average growth.

4.6.2 Random effects estimations evidence

As our distance measure is constant over the time, random effect panel estimations are suited. For a relevant comparison, it is necessary to include the aggregate level of financial reforms in our specifications. These estimations allow us to include the dynamics of reforms level over the time by controlling for the lag level of reform.

The following specification is estimated:

$$Y_{it} = \alpha + \beta_1 D_i^j + \beta_2 FL_{it-1} + \beta_3 D_i^j * FL_{it-1} + \theta X_{it} + (u_{it} + \psi_i) \tag{10}$$

Where D_i^j the distance between the trajectories of financial reforms followed by country i and a benchmark country j

FL_{it-1} is the lag of aggregate level financial reform and X_{it} is a set of control variables;

u_{it} and ψ_i denote respectively the idiosyncratic error term and random indivivual effects.

We expect that the lag level of aggregate financial reform affects positively GDP-per-capital growth, i.e. $\beta_2 > 0$; that for two countries which reach the same level of financial reform, the difference between their reform sequences and the sequence recommanded by Fisher and Reisen (1994) affects positively the GDP per capita growth, which implies that $\beta_3 < 0$. Finally, we have no prior about the sign of β_1. The total impact of sequence differences is given by: $\hat{\theta} = \hat{\beta_1} + \hat{\beta_3} * FL_{it-1}$. A negative total marginal effect indicates that a lower distance from the "Washington concensus" is associated with higher growth.

Considering the whole sample, the empirical results from RE estimations support the idea that for a same level of aggregate financial, the countries which sequence of financial reforms adoption is close to Fisher and Reisen (1994) perform better than the other (Column 1 of table 8. and 9.); and that after controlling for this effect, the lower distance is associated with a lower GDP per capita growth. In addition, it seems that the global effect of distance become positive ($\hat{\theta} < 0$) when the aggregate level of reforms reaches 0.694.

A closer look at these results suggest an high heterogeneity in the impact of sequences difference. It seems that the sequence matters only for Emerging Asia countries and Transition countries. For these countries the total effect of distance from Fischer and Reisen (1994) on growth becomes positive ($\hat{\theta} < 0$) when the level of aggregate financial reforms is respectively above 0.6838 and 0.934. As can be seen, the likelihood that a sequence in transition countries be associated with a positive effect is lower as 90% of countries have an aggregate level of reforms lower than 0.917. While for Emerging Asia countries, 75% of countries have a level of aggregate reforms below 0.667.

Table 10: RE evidence distance from Fisher & Reisen (1994):

DEP: GDP per Cap.	Whole sample	Emerging	LAC	SSA	Transition
distance	5.712***	12.48***	2.409	-2.684	29.45***
	(1.980)	(3.553)	(2.590)	(4.926)	(9.074)
Aggregate fin. ref Level (lag)	10.69***	27.22***	11.22*	9.480	55.57***
	(3.010)	(8.062)	(5.964)	(11.08)	(16.35)
Distance*Aggregate fin(lag)	-8.232***	-18.25***	-7.278	-6.815	-31.53**
	(3.073)	(6.231)	(5.362)	(11.25)	(15.78)
Observations	1,809	217	359	308	181
Number of code1	79	8	13	13	17
R^2 (Between)	0.09	0.722	0.04	0.366	0.078

[35]Note : (***), (**) (*) mean respectively significant at 1%, 5% and 10%. Other control: currency crisis, banking crisis, debt crisis, Population (Lag), Infrastructure, politcial regime change, Trade openess (Lag)

Table 11: RE evidence distance from Fisher & Reisen (1994): Raw substitution cost

DEP: GDP per Cap.	Whole sample	Emerging	LAC	SSA	Transition
distance	5.660**	7.742*	0.469	1.503	47.50***
	(2.263)	(4.478)	(3.368)	(7.962)	(12.62)
Aggregate fin. ref Level (lag)	10.82***	20.84**	8.433	13.06	72.47***
	(3.173)	(9.328)	(6.847)	(16.85)	(21.74)
Distance*Aggregate fin(lag)	-9.141***	-14.73*	-5.236	-11.02	-58.07**
	(3.544)	(7.723)	(6.845)	(18.28)	(23.00)
Observations	1,809	217	359	308	181
Number of code1	79	8	13	13	17
R^2 (Between)	0.092	0.466	0.039	0.159	0.179

[36]Note : (***), (**) (*) mean respectively significant at 1%, 5% and 10%. Other control: currency crisis, banking crisis, debt crisis, Population (Lag), Infrastructure, Political regime change, Trade openess (Lag)

5 Conclusion

This paper assessed the impact of reforms trajectories adopted by countries on their GDP per capita. To this end, it used innovative methodologies. The first innovation is related to the construction of sequence similarity. To our knowledge this study is the first to have proposed the use of Optimal Matching sequence analysis in order to compute the distance between the trajectories of financial reforms followed by different countries. The second innovation is related to the assessment of the effect of sequence. In this paper, we construct theoretically some "desired benchmark trajectories" of financial reforms and then used rank correlation and synthetic counterfactual approach to show the impact of sequence on our outcome indicator. Using these

methodologies, our results suggest that GDP per capita growth is positively related to the trajectory of reforms adopted in a given economy but that this result is not held for all groups of countries.

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6 Appendix

Table 12: Cost substitution matrix

-		Privatization	Banking supervision	Entry barriers	Interest rate deregulation	Securities markets	Capital acc. liberalization
Entry barriers	$S(1,1)$	$S(1,2)$	$S(1,3)$	$S(1,4)$	$S(1,5)$	$S(1,6)$	$S(1,7)$
Int. rate deregula.	$S(2,1)$	$S(2,2)$	$S(2,3)$	$S(2,4)$	$S(2,5)$	$S(2,6)$	$S(2,7)$
Securities markets	$S(3,1)$	$S(3,2)$	$S(3,3)$	$S(3,4)$	$S(3,5)$	$S(3,6)$	$S(3,7)$
Capital acc. lib.	$S(4,1)$	$S(4,2)$	$S(4,3)$	$S(4,4)$	$S(4,5)$	$S(4,6)$	$S(4,7)$
Privatization	$S(5,1)$	$S(5,2)$	$S(5,3)$	$S(5,4)$	$S(5,5)$	$S(5,6)$	$S(5,7)$
Banking supervision	$S(6,1)$	$S(6,2)$	$S(6,3)$	$S(6,4)$	$S(6,5)$	$S(6,6)$	$S(6,7)$

Table 13: Frequency of financial crises

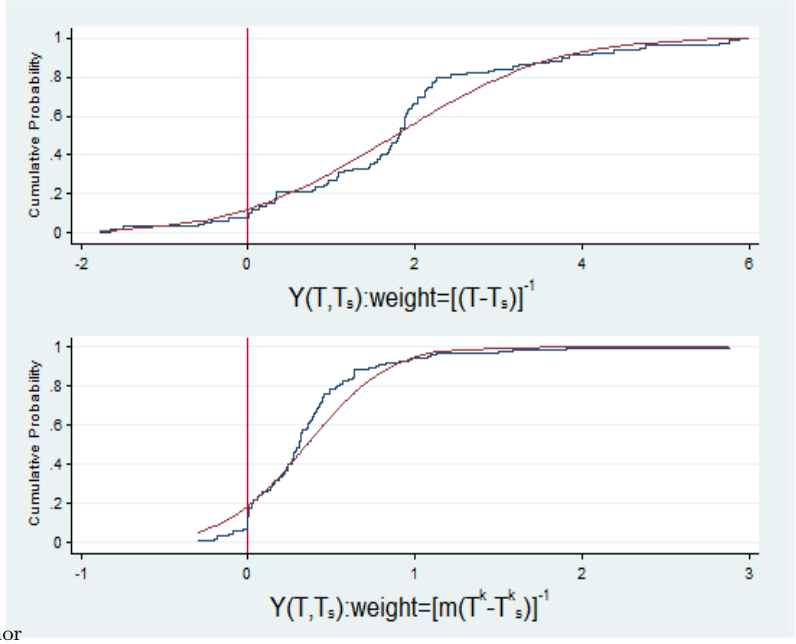
Crises	DEBT					CURRENCY					BANKING				
	Asia	LAC	SSA	Trans.	MENA	Asia	LAC	SSA	Trans.	MENA	Asia	LAC	SSA	Trans.	MENA
1973-1980	0	2	0	-	1	3	7	1	-	1	0	1	0	-	0
1980-1990	1	11	8	-	3	2	20	10	-	4	5	11	7	-	4
1990-2004	1	4	0	2	0	5	14	12	15	4	5	15	6	15	3

Table 14: GDP per capita volatility predictor means

Predictors	Treated	Synthetic
Aggegrate fin.reform level(1980)	0.2381	0.2090
Aggegrate fin. reform level(2004)	0.7143	0.7130
GDP per cap growth(1976)	8.7386	8.7150
GDP per cap growth(1977)	8.704755	8.7088
GDP per cap	7375.583	6239.665
Exchange rate stability	0.0177	0.0166
KAOPEN	-0.7828	-0.6539
Monetary independence	0.2246	0.2334

[38]Note: Banking crisis, Currency crisis and Debt crisis also included

Figure 10: Distribution of weight growth: the role of status quo



[37]Source: Author

Table 15: Country weights in Synthetic Korea

country	Weight	country	Weight	country	Weight
Argentina	0	Jamaica	0	France	0.061
Australia	0	Japan	0	United Kingdom	0
Austria	0.02	Kenya	0	Ghana	0
Belgium	0	Korea	-	Greece	0
Burkina Faso	0	Sri Lanka	0	Guatemala	0
Bangladesh	0	Morocco	0	Hungary	0
Bolivia	0	Madagascar	0	Indonesia	0
Brazil	0	Mexico	0	India	0
Canada	0	Malaysia	0.004	Ireland	0.011
Switzerland	0	Nigeria	0	Israel	0
Chile	0	Nicaragua	0	Italy	0
Cameroon	0	Netherlands	0.01	Senegal	0
Colombia	0	Norway	0.01	Singapore	0.14
Costa Rica	0	Nepal	0	El Salvador	0
Denmark	0.001	New Zealand	0	Sweden	0
Dominican Republic	0	Pakistan	0	Thailand	0.317
Algeria	0	Peru	0	Tunisia	0
Egypt	0.451	Philippines	0	Turkey	0
Spain	0	Portugal	0	Uruguay	0
Finland	0	Paraguay	0	United States	0.002
				South Africa	0
				Zimbabwe	0