

# Redefined fundamental uncertainty, fiscal rules, fiscal net, fiscal sustainability and emerging markets scenarios

**Gevorkyan, Aleksandr V.**

**Gevorkyan, Arkady**

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## Abstract

Sustaining initial blows of the crisis of late 2000's, emerging markets may now be operating in the perfect storm environment pulling into single totality problems of adequate fiscal balance, capital flows, exchange rate volatility, foreign currency denominated debt, industrial development, and social balance. In this environment, the fiscal state assumes a stabilizing role counterbalanced by limited financial capacity. To the extent relevant on the global scale this paper develops bare-bones analytical fiscal policy rules model under uncertainty, optimized for a controlled fiscal revenue mix via superfund, with preexisting social commitments and economic priorities. The paper advances a concept of redefined fundamental uncertainty as characteristic feature of the post-crisis economy with concerns over growth sustainability. Hypothetical post-crisis scenarios based on nonlinear model predictive control algorithms are reviewed and fiscal net framework is conceptualized as analytical proxy stability measure.

## Keywords:

Fiscal net, Emerging financial markets, Global crisis, Foreign reserves, Fiscal policy rules, Fiscal superfund, Foreign currency denominated debt, Redefined fundamental uncertainty, Nonlinear model predictive control.

## JEL classification:

C6, E5, F3, G1, P2.

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Gevorkyan, A.V. Ph.D. ✉ New York University and Columbia University, New York, NY, Paul McGhee Division, 7 East 12th Street, 6th Fl., New York, NY 10003. E-mail: [ag168@nyu.edu](mailto:ag168@nyu.edu) or <http://agevorkyan.com>. Views expressed in this paper are those of the authors and do not represent the views of the institutions authors are affiliated with.

Gevorkyan, A. M.Sc. The New School University, NSSR, New York, NY. E-mail: [gevoa020@newschool.edu](mailto:gevoa020@newschool.edu)

# La incertidumbre fundamental redefinida, las normas fiscales, el neto fiscal, la sostenibilidad fiscal y los escenarios de los mercados emergentes

Gevorkyan, Aleksandr V.

Gevorkyan, Arkady

## Resumen

Padeciendo los golpes iniciales de la crisis de finales de 2000, los mercados emergentes pueden estar operando ahora en el ambiente de la tormenta perfecta de entrar en problemas, a la vez, en lo que se refiere al equilibrio fiscal adecuado, los flujos de capital, la volatilidad del tipo de cambio, la deuda denominada en moneda extranjera, el desarrollo industrial y el equilibrio social. En este entorno, la situación fiscal asume un papel estabilizador compensado por la capacidad financiera limitada. A escala global, este trabajo desarrolla el esqueleto de un modelo analítico de normas fiscales en condiciones de incertidumbre, optimizado por una combinación controlada de ingresos fiscales vía superfondo, compromisos sociales asumidos y prioridades económicas. Este artículo avanza un concepto de incertidumbre fundamental redefinida como rasgo característico de la economía post-crisis preocupada por la sostenibilidad del crecimiento. Se examinan hipotéticos escenarios post-crisis basados en algoritmos control predictivo basado en modelos no lineales, y se conceptualiza el marco fiscal neto como proxy analítica de una medida de estabilidad.

## Palabras clave:

Neto fiscal, mercados financieros emergentes, crisis global, reservas de divisas, política fiscal, normas fiscales, superfondo fiscal, deuda denominada en moneda extranjera, incertidumbre fundamental redefinida, control predictivo basado en modelos no lineales.

## ■ 1. Introduction

The pompous façade of the now dominant script of financial economics that posits excesses of risk mispricing and securitization as the single causes for the late 2000's crisis, at best, provides only partial explanation. Instead, more inclusive approach may lead to a *totality* of finance with lesser-understood self-expansory economic dynamic of emerging markets.

Two aspects are of interest: a) evolution of the overall economic instability by way of *redefined fundamental uncertainty (RFU)*, and, due to that, b) the inadequacy of simple equilibrium solutions in macroeconomic policy leading to a visible reassertion of the fiscal role in development. The latter point brings the role of a proactive fiscal policy to the forefront.

Here a range of factors is relevant, including (but not reduced to) problems of population growth, labor migration, rising consumer societies driving up demand pressures on real and financial sectors; technological advance facilitating faster financial transactions, along with easier access to new and mass-produced goods, satiating global demand, yet with increasing profit and entrepreneurial risk. Adding to the mix are fluctuations in exchange rates, asset prices fluctuations, portfolio and direct investment flows as they impact financial and real sectors.

Importantly, evolution of sovereigns' social obligations at current development stage elevates economic stability problem to a new methodological context. That merges a pro-growth, pragmatic, and innovative fiscal policy in balance with problems of social development. This paper attempts sketching fiscal policy rules and post-crisis scenarios under the *redefined fundamental uncertainty* that *repositions* the uncertain environment of the emerging economies.

As such the paper invokes debates on economic crisis, financial intermediation, macroeconomic policy mix, optimal fiscal policy and fiscal rules with general understanding of open-economy emerging markets capital flows and country's economic and social development path, among others. For brevity general emerging markets examples, China aside, are considered.

Following this introduction, Section 2 develops a theoretical view of redefined fundamental uncertainty concept linked to current macroeconomic environment. Section 3 extends the conceptual discussion and reviews some pertinent stylized facts in emerging markets. Section 4 extends the foregoing discussion evaluating fiscal rules and introducing concepts of a wealth fund (fiscal superfund) and fiscal net with multiple revenue sources controlled by the increasing role of the state in economic development. Section

5 develops a dynamic fiscal policy optimization model for emerging markets in the RFU environment. Drawing on accumulated evidence Section 6 develops post-crisis scenarios under RFU relying on nonlinear model predictive control (NMPC) algorithms. Section 7 concludes the paper summarizing its key theoretical and macroeconomic policy aspects.

## ■ 2. Redefined Fundamental Uncertainty

The theoretical premise behind this paper’s argument on *redefined fundamental uncertainty* is rooted in a well-known strand of literature on economic dynamics and financial crises and role of state in economic development. Not surprisingly, early methodological framework on the topic significantly pre-dates much of recent macroeconomic shifts and adjustments in fiscal space and financial markets. Still some empirical literature is more recent. Cognizant of such intellectual treasure-chest we try to tune in with only few most representative and relevant contributions.

### Theoretical Basis

One may start by considering investor’s *uncertainty* about future returns in relation to initial capital endowment. Standard financial literature treats that as mainly due to exogenous factors outside of investor’s immediate control, i.e. *systematic* or *market* risk inherent even in well diversified utility maximizing and risk minimizing optimal portfolios of a mean-variance efficient set (e.g. Statman, 1987; Markowitz, 2012 and 1952; etc.). Yet, writing earlier, in his highly influential monograph Knight (1921) differentiates between a quantifiable risk to profits and, more severe, unquantifiable uncertainty. Here uncertainty relates to unpredictable, unknown, course of events in economy and business operations leading individual entrepreneur to a monetary loss (or profit, equally so). Knight’s interpretation is therefore more nuanced leading to more significant disturbance in the economic system. A related interpretation would generalize that on a systematic-scale such (Knightian) uncertainty may potentially result in individual sector restructuring as businesses adapt and investment follows.

As much as that tendency merges technological advance and profit motives (e.g. financial innovation?), on a very approximate level this Schumpeterian (1934) change is arguably spurred by accumulated financial markets instability. In the formally post-crisis period it is rebuffed by persistent uncertain business conditions partly due to lackluster macroeconomic improvements across global economy (with primary risks in the US recovery, European Union debt and recession crisis, and China’s slowdown) and new complex financial markets regulations.

Back in abstract theoretical context, Kalecki (1937) develops the *principle of increasing risk*. The gist of the argument suggests, that aside from continuous overleveraging, partly

to sustain operations and partly to seek expansion as business improves, rising borrowing costs on aggregate and intensifying competition push to achieve yet higher investment return. This dynamic takes place on almost subconscious level. Yet, eventually the required rate of return (i.e. also cost of borrowing) exceeds the generated return (return on profits) ending in a financial bust. On a micro-level this relates to balanced decisions of own vs. borrowed funds use, ultimately affecting firms' planning and production decisions in the medium term (e.g. see recent reports on hedge funds industry reported daily on business networks). The expected result might again be similar to the adjustments described above, which in broader macroeconomic terms one can also relate to transformational growth exposition as in Nell (1992). To some this may be reminiscent of Kondratieff long waves argument (e.g. Kondratieff, 1935) and its ramifications for the modern economy (Bernard *et al.*, 2012).

Extending the individual firm, or sector, contribution to macroeconomic tendency, Keynes (1936, 1937) develops an all-encompassing view of financial markets instability with impact on fiscal space and macroeconomy. His “*animal spirits*” analogy dominating the capital markets behavior along with the “beauty contests” of cherry-picking the winning stocks have made a forceful comeback in the few years since the current crisis.

Based on Keynes's argument Minsky (1975, 1982, 1992), identifying three types of borrowers (hedge, speculative, and *Ponzi*) with apparent distinctions between lender's and borrower's risk, develops *financial instability* hypothesis as endogenous to modern financial markets. Here things actually start getting worse when times are good as increased debt burdens and speculation lead to unprecedented instability in finance, with banks' profit maximizing behavior at the forefront. One may relate this to the Kaleckian principle of increasing risk where, as mentioned, firms' unconscious decisions to over-leverage in boom times effectively usher destabilization as the ballooning system based on poorly quantifiable risk disintegrates.

Fazzari and Variato (1994) contrast that Kaleckian-Keynesian-Minskyan (KKM) *fundamental uncertainty* driven by asymmetric information with the efficient markets based influential Modigliani-Miller theorem (MMT). The latter questions the relevance of capital structure in firm's valuation. Insightful otherwise, the MMT loosely suggests that firms' finance decisions (i.e. reliance on own or borrowed funds) matters little to valuation as long as firms remain competitive (Modigliani and Miller, 1958). Barring aside Schumpeterian like events (Schumpeter, 1934) an individual firm bankruptcy cancels out in the multitude of financial transactions, unless there is a synchronized meltdown (e.g. Great Depression and Great Recession). Implicitly then, for capital market investors the rule is to diversify sufficiently enough to minimize idiosyncratic risk of a particular stock, sector, or regional market.

Unfortunately, the recent crisis suggests otherwise: firms capital structure and balance sheets matter. More so, aside from sector impact, the inherent uncertainty matters on a scale of national economy comprised of a sum of domestic and foreign individual investors' competitive profit maximizing behavior given market instability. But despite profit seeking behavior, which by default minimizes losses, market risk remains undiversified and omnipresent (e.g. Dymski and Pollin, 1992). And even simplifying complexity of involved decisions to a "market risk mispricing" spills instability from financial markets into the real sector. This is where financial economics faces off modern emerging (and advanced, too) markets' development strategies.

### The "Redefined" in a Macro Picture

In a slightly different connotation, Alchian (1950) introduces uncertainty as an inherent feature of the economy. Dynamic adaptability to the changing economic environment forces firms to adopt business strategies that over time contribute effectively to positive profitability. In finance this is yet another manifestation of the Schumpeterian adjustment and Minskyan financial innovation.

This leads our exploration to economists' recent recognition of and efforts to address the problem of a merged finance-real economy's uncertainty. Referencing already mentioned portfolio optimization strategies, Hansen (2012) draws demarcation between quantifiable *systematic* risk and *systemic* risk as both affect financial and real sides of the economy macroeconomics. He considers systemic risk to be a risk "of breakdown or major dysfunction in financial markets" (p. 4). While rare, such integrated view speaks closely to our conception of RFU notion. Importantly, Hansen (2012) finds no immediate consensus among economists and finance professionals on systemic risk's appropriate measures.

Another recent survey exploring empirical measurement of systemic risk across economic and finance literature is by Bisias *et al.* (2012). In this monumental study that spans across very diverse and at times contradictory literature, the authors emphasize the need for filtering and transforming strictly economic (i.e. often immediately unobservable) trends in more clear-cut choice variables that can be aggregated and absorbed on a more general level by involved economic agents.

The topic is relatively fresh in modern financial economics and various studies offer new and additional treatments. Some perspectives vary from stability to financial system threats (e.g. Billio et al, 2010), real economy spillovers, to a wide-scale comprehensive negative phenomenon that disrupts entire financial system with a disrupting impact to real economy and social welfare (ECB, 2010). The latter definition is more in tune with our subsequent discussion.

By now, it should be clear that the problem for emerging markets boils down to not just concerns over financial outflows but, importantly, also problems of economic diversification, industrial policy, and social stability. Therefore, fundamental uncertainty of joint KKM construct is now enriched with more recent exploration of financial flows and asset prices volatility.

For a sovereign with limited fiscal revenue sources but faced with immediate social obligations this means, sometimes, drastic adaptation in light of severe markets' breakdown. It is this multitude of factors shaping the fragility of capital markets-dependent economies that contributes to our understanding of the *redefined fundamental uncertainty*. With no pretense to originality, one may characterize the RFU propagating environment by:

1. Global market: explicit and implicit interlinks among diverse economies - contagion.
2. Asset prices volatility (especially in currency trade and commodities) reinforced by technology allowing simplified momentous cross-border significant financial transfers.
3. Investors' unbending demand for higher returns as advancing technology opens up new speculative opportunities.
4. Evident decoupling of the financial and real in modern economy.
5. Rebalancing of the global economy (deindustrialization in advanced and emphasis on industrialization in the emerging markets and uneven human capital development).
6. Sovereign debt pile-up and limited access to (and/or run-down on) international reserves.

These six factors, while not exclusive, seem to have reshaped the global macroeconomy contributing as core pressures on both advanced and developing economies. The fast-paced change pushing for higher benchmarks and returns adds to instability and uncertainty. In Keynes's words "we simply do not know" when a higher sense of stability may reappear to nurture productive vs. speculative financial flows. A typical relatively well-diversified investor may pull out of a typical emerging market in a short period of time minimizing losses under prevalent portfolio optimization scheme.

For less-liquid and less-capitalized, emerging markets reliant on foreign currency factor in the economy such abrupt changes invoke crisis prone behavior. Semmler and Gevorkyan (2011) describe a step-by-step chain of events leading to a financial crisis with direct hit on current account, exchange rate, financial sector and real economy. Effects are especially dramatic in countries that had experienced a net foreign capital inflow prior to abrupt capital flight, in particular in foreign currency denominated transactions. This then presents a significant threat to domestic economic stability and often may spill into other markets.

Similar episodes are well recorded (e.g. currency and financial crises in Mexico 1994, East Asia 1997, Russia 1998, and Argentina in early 2000's) and abundantly discussed in literature (e.g. Kamin, 1999; Krugman, 2000; Flaschel and Semmler, 2003; Gevorkyan, 2011; Calvo *et al.*, 1993; Reinhart *et al.*, 2012; and Reinhart and Rogoff, 2008; etc.). The appropriate reaction would be the relevance of potential policy response in the current conditions.

What is new is the current situation where investors have limited options for alternative higher returns investment opportunities as both advanced economies and emerging markets are in post-crisis dire straits. In some cases, as in recent successful floating by Mexico and Peru of respectively 100 year and 40 year maturity bonds, the potential profits still may outweigh calculated investment risks. This is still beneficial for the issuing market even if such investments are speculative from the investor's point of view and securities are not held to maturity. Yet in more general cases there are circumstances under which even the lure of abnormal profits of the emerging markets submit to the escalating risks of financial and currency crisis in the background of underdeveloped industrial mix (Calvo *et al.*, 1993).

The uncertainty facing investors (including large institutional, private investors and multinational corporations following diversification strategy) is then manifested in their decision to whether returns in the home (i.e. advanced economy) market are disproportionately low, despite perceived stability/predictability, to warrant a risky move and bet on economic prospects of an emerging market. Financial investor aside, a simple analogy would be a profit seeking manufacturing firm (e.g. Apple, for easier recognition) moving to cheaper labor markets in the emerging economies: boosting manufacturing base abroad and contributing to now popular argument of deindustrialization in advanced world (Minian, 2012; Grossman and Helpman, 2005). The outsourcing argument to business structure diversification, especially in information technologies sector, is only secondary to a longer term profit motive.

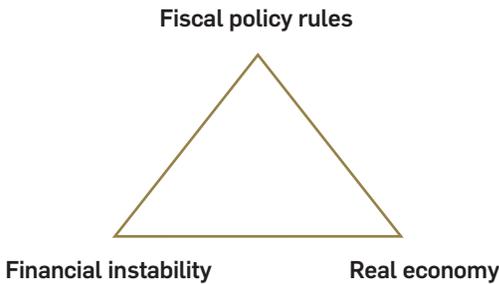
In turn, a mix of uncertainty pertaining factors facing emerging markets is more substantial. One must understand what exactly determines the economic foundation (and prospects) of an emerging market, as many of those economies follow diverse macroeconomic policies (e.g. compare Brazil to Russia, and both to the U.S. or U.K.). Aggregate and sector distribution of payroll, employment, credit, and technology in balance with fiscal and monetary policy priorities all converge in a fragile developing open economy. More complexity arises once a sovereign relative position is weighted by specific social obligations.

As emerging economies enter the uncertain international capital markets yet relying on external foreign currency denominated inflows and with less-diversified economic basis,

the stakes rise. It is this dynamic relationship that leads to the *redefined fundamental uncertainty*, affecting less-capitalized emerging markets' economic development plans.

In simplified presentations, RFU may be viewed as merging three main considerations from preceding discussion (Figure 1): financial market instability; economic development prospects; and pro-growth policy mix with strong pro-development emphasis on fiscal policy (monetary policy components enter the first, financial, variable).

■ **Figure 1. Redefined Fundamental Uncertainty: Simple View**



Note that for emerging markets, broad financial instability concept also relates to volatility in currency rates, capital flows, credit, and stock market fluctuations. Given the political economy of these countries state becomes an important “market maker.” Here a successful fiscal policy can make a level changing positive impact on overall economy. RFU then evolves as a totality of contradictory tendencies in modern macroeconomic development.

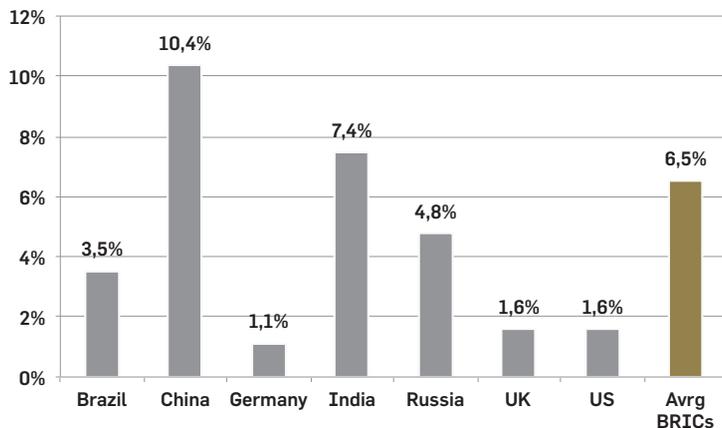
### ■ **3. Some Stylized Facts on Emerging Markets**

Before we address a theoretical fiscal rules model and RFU, a more abstract question is pending: what are the emerging markets and what can one say about them? By now, the term emerging market has become so common that few ever wonder which out of 200 shy countries are actually categorized as *emerging*.

The simplest and, incidentally, one of the earliest approximations dates back to Antoine van Agtmael's of the International Finance Corporation (IFC) proposal to use “emerging markets” in place of “third world”. At the time, van Agtmael marketed a “Third World Equity Fund” until someone recommended him finding a more elegant terminology (e.g. Kotkin, 2007).

More generally, one easily links recent popular interest in emerging markets concept with by now familiar notion of BRICs (Brazil, Russia, India, and China) economy defined by Goldman Sachs (O'Neill, 2001) and recently suggested elsewhere (Keohane, 2011).

**Figure 2. BRICs vs. the Advanced Economies (CAGR GDP Growth for 2000-2011)**



SOURCE: IMF WEO (2012) AND AUTHORS' CALCULATIONS

The initial BRICs designation was largely due to their tendency for faster growth (Figure 2). Moreover, collectively BRICs represent a sizeable 22% of the world economy in current prices GDP in 2012 according to the International Monetary Fund. Other large economies may also count as emerging due to promising growth despite variations in debt, employment, monetary policy, and institutional reform. For example, the G20 group has quite diverse membership of the world's top 20 economies including developed and emerging alike (G20, 2012).

One of the earlier systematized studies on emerging markets taxonomy was Mody (2004). Already then, inconsistencies with “emerging” classification lumping a country with minimal GDP per capita and low institutional base with another that had significantly higher GDP per capita yet still evolving institutions (e.g. Argentina with \$11,453 and Bangladesh with \$700 in per capita GDP as of 2012 estimate) were questioned. In addition, Mody (2004) mentions the high degree of economic and political volatility characterizing emerging markets. This suggests a dynamic search for sustainable economic and institutional models with subsequent problems of commitment to a chosen policy targets (e.g. inflation, exchange rate) and institutional backing.

The debate on “emerging” categorization is ongoing (and paradoxical at times) across a range of factors and multitude of opinions (e.g. Knowledge@Wharton, 2008). While economists tend to lump a larger proportion of what technically is known as developing

under “emerging” umbrella; financial market participants are more selective and actively adjust their reference grouping based on market returns, volatility, capitalization, and macroeconomic indicators. In other words, are “emerging” only those economies that have a functioning stock-market? In this respect, there is very little difference for a speculative investor (e.g. Gevorkyan, 2012a) in broader and socially substantive macroeconomic fundamentals as financial return considerations take precedence.

In technical terms countries with “emerging” designation are fast-growing with a chance of higher financial return but also carry higher financial losses risk than others. Country’s openness to foreign investors is a significant factor in financial firms’ categorization decisions. Depending on investor class, preference for asset volumes may also be explicit categorization factor.

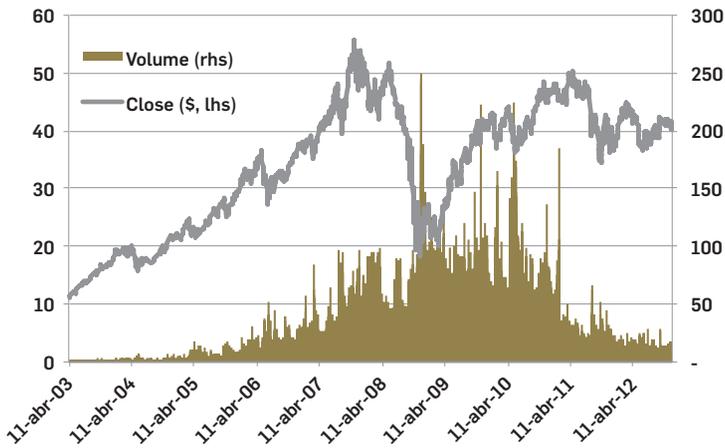
Methodological issues aside for the purposes of this paper we focus on the MSCI (Morgan Stanley Capital International) Emerging Markets index (MSCI, 2012). Various other classifications exist (e.g. EM subcategories have been developed and are utilized by FTSE, S&P, Goldman Sachs, Grant Thornton, Vale Columbia Center, IMF, and others).

Figure 3 plots the iShares exchange traded fund (ETF) of the MSCI index. The MSCI index is based on over 2000 securities aggregation and includes Brazil, Chile, China, Colombia, Czech Republic, Egypt, Hungary, India, Indonesia, Korea, Malaysia, Mexico, Morocco, Peru, Philippines, Poland, Russia, South Africa, Taiwan, Thailand, and Turkey in regional groupings.

One evident result is the high volatility of returns in the markets taken together and uneven demand in volume of total trades. Interestingly the spike in volume (rising demand for securities in the index countries) occurs on and around early in 2009. Given higher real interest rates (see data in WDI, 2012), one can suggest that on aggregate there have been sporadic investors’ runs for higher returns in the emerging world away from the troubles in the advanced economies (especially during initial post-late 2008 period).

The pattern is not entirely uniform and the “fundamentals”, i.e. macroeconomic indicators, support the claim of uncertainty and instability in the emerging economies. For example, annual GDP growth collapsed to maximum of negative 7.8 percent in Russia while it remained at relatively high (in fact grew) 6.6 percent level in India. Still with India’s exception overall average loss in growth was close to 5 percent for the group. Further, as growth rates bounced back to positive levels in 2010 by end of 2011 and, according to IMF’s forecast, there is already visible tendency to more moderate levels. Note that we omit China (for scale) and Taiwan (for lack of reliable data). This is consistent with the remaining charts and analysis.

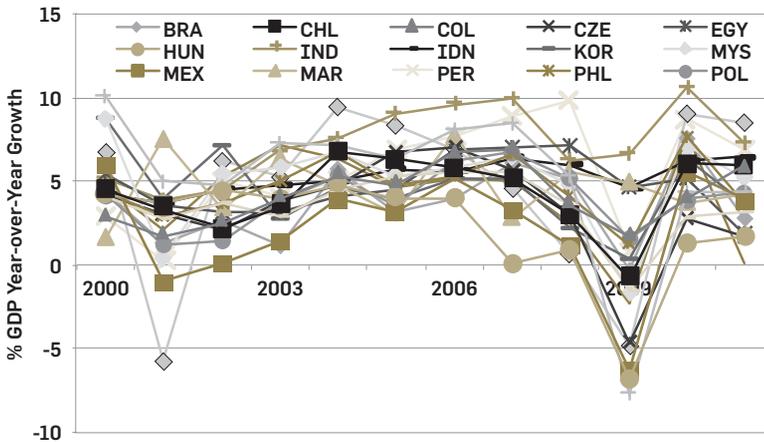
■ **Figure 3. MSCI Emerging Markets Index ETF (Close and Volume)**



SOURCE: GOOGLE FINANCE / ISHARES MSCI EMERGING MARKETS INDEX (ETF).

Note that in terms of global recession, the MSCI EM index countries felt the negative impact with some delay (Figure 4).

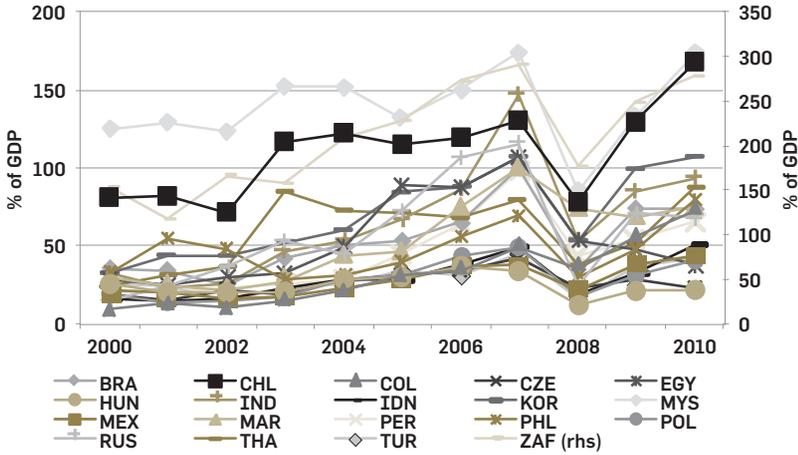
■ **Figure 4. Gross Domestic Product in the MSCI EM, Constant Prices, % y-o-y**



SOURCE: WDI (2012) AND AUTHORS' CALCULATIONS.

It is then interesting to note (Figure 5) the initial drop in the group's market capitalization, as percent of GDP, occurring in 2008 preceded by uneven yet rising volume in prior years.

■ Figure 5. Market Capitalization in the MSCI EM, % of GDP



SOURCE: WDI (2012) AND AUTHORS' CALCULATIONS.

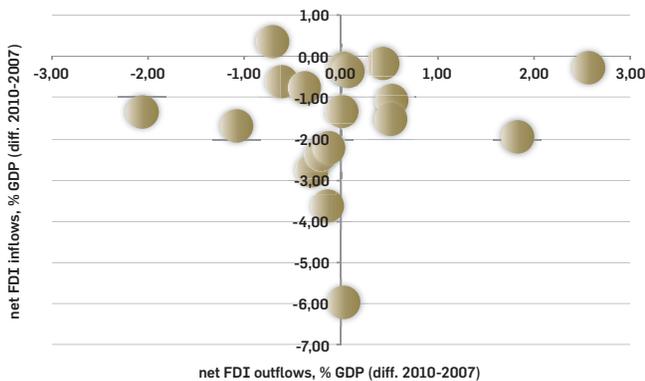
As capitalization dropped more than 45 percent in 2008 (compared to 2007) it recovered more than double in 2009, returning to pre-crisis levels in 2010. Prior to that capitalization grew at 31.3 percent CAGR between 2000 and 2007 with triple digit growth between individual years. Aside from internal macro issues in each of the involved economy uncovered by the crisis, this decline in market capitalization volumes and trend lends support to our argument of RFU and high probability of a sudden and severe liquidity outflow from industrially less-diversified markets. Realization of this motive is essential in our subsequent argument.

One could also see the troubles of the emerging markets by looking at the ratios of foreign direct investment (FDI) inflows and outflows compared as difference between 2010 and 2007 GDP shares, as shown in Figure 6.

Note that FDI outflows indicator measures outside foreign investment (OFDI) by domestic firms as opposed to a more popular concept of capital flight often associated with volatile markets.

In that regard, in their majority the 19 countries studied here have experienced strong declines in FDI inflows still not recovering to pre-crisis levels in 2010. It is peculiar that impact on outflows (which may be due to scale effect of large emerging markets' multinationals, e.g. Gevorkyan, 2012a) does not appear as severe, with few still below 2007 levels but many recovering and increasing their OFDI GDP shares.

**Figure 6. Foreign Direct Investment, MSCI EM, Inflow and Outflow as % of GDP**



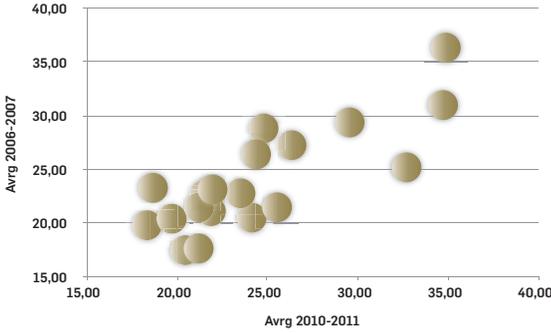
SOURCE: WDI (2012) AND AUTHORS' CALCULATIONS.

We have purposely excluded Hungary from Figure 6 analysis due to this economy's most severe impact in the group. The first difference on inflows was negative 81.3 and for outflows negative 82. This is a very significant impact for a relatively well-diversified and EU integrated post-socialist economy that remains on the "promising" fast-growth list. Yet, the true impact to the country's industrial policy and business development remains unclear.

Overall investment in emerging markets (that includes domestic and foreign, private and public measures) has also followed a predictable post-crisis pattern (Figure 7). With four exceptions (Indonesia, Morocco, Peru, and Philippines) ratio of total investment to GDP declined on average for 2010-2011 compared to pre-crisis 2006-2007. Most saw a significant decline in total investment volumes post-crisis (e.g. Hungary from 23.3% to 18.7%, India from 36.3% to 34.9%, Russia from 23.2% to 21.9%, and others).

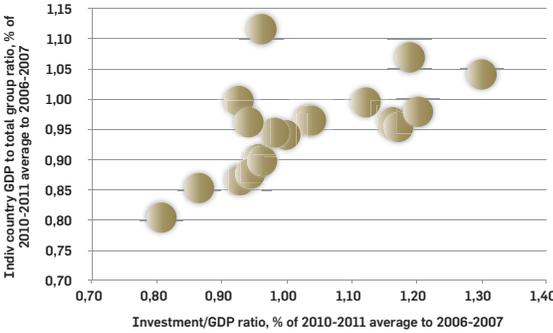
Looking at this from a different perspective, Figure 8 plots difference in total investment to GDP ratio of 2010 and 2011 average to 2006-2007 average with a similar ratio in individual country's rank in the total group (measured as country's GDP to total group's GDP in respective years). The immediate result is again lack in trend pattern uniformity. While a handful of economies recovers their pre-crisis total investment shares, many remain below the 100 percent recovery with lower investment to GDP shares. At the same time, even those that may have gained their investment shares back in 2010-2011 remain at below pre-crisis GDP levels as is evident from Figure 8.

**Figure 7. Total Investment Shares of GDP, %**



SOURCE: WDI (2012) AND AUTHORS' CALCULATIONS.

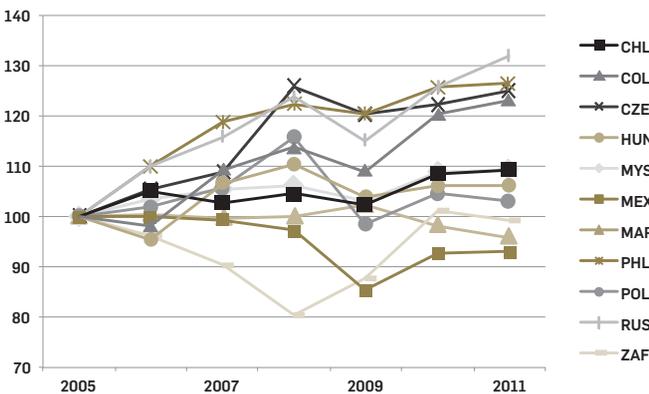
**Figure 8. Relative Placement by Total Investment and Individual GDP Rank**



SOURCE: WDI (2012) AND AUTHORS' CALCULATIONS.

To avoid an overload in charts we summarize with a reference to two more indicative statistics: real effective exchange rate (REER) and fiscal balance. Both are relevant for our subsequent discussion as part of the fiscal rules optimization model.

**Figure 9. Real Effective Exchange Rate Index (2005=100)**



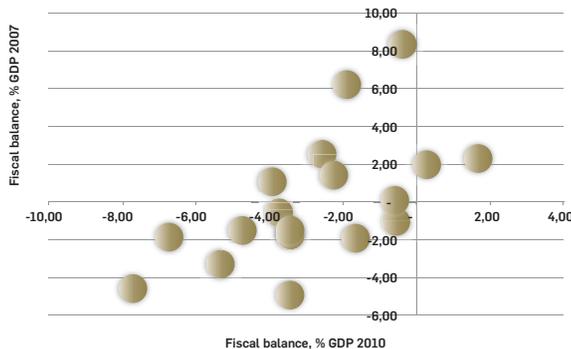
SOURCE: WDI (2012) AND AUTHORS' CALCULATIONS.

In principle the REER (plotted in Figure 9 for a selected sub-group due to data availability yet still indicative of a general trend) follows by now expected pattern: strong decline in national currencies' values during the 2008-2009 crisis years. What is interesting is the general overall tendency to appreciation in national currency vis-a-vis 2005 index. A more peculiar insight from Figure 9 data is that performance across resource exporters was not uniform (e.g. contrast Russia and Mexico's currencies), while other non-energy exporters (e.g. Czech Rep.) have also seen significant appreciation in pre-crisis years. This leads to a suggestion that other mechanisms, and specifically the financial market, are in play here as investors' rising appetite for local currencies in the background of conservative monetary policy (e.g. European countries) is driving up REER as easily as it may in short-time recede (e.g. Semmler and Gevorkyan, 2011).

Finally, Figure 10 relates the story of fiscal balance as a ratio of country's GDP that, to some, may seem well too familiar yet again. Driving the point home we are seeing significant deterioration in the fiscal balance across the MSCI EM index group. For some better performers in other respects this statistic has deteriorated, i.e. increasing fiscal deficit, more than 4.7 times, e.g. Thailand or Czech Rep's ratio of 3.2 times deficit expansion as percent of GDP.

Only in two countries, Korea and Peru, fiscal balance held surplus position between 2007 and 2010. Adding to complexity of emerging markets' analysis is the fact that central government's debt has stayed at relatively unchanged levels for each country respectively. While the range in GDP shares is quite high (from lows of 9.3% of GDP in Russia to highs of 82.6% of GDP in Hungary), it is significant that central government debt to GDP ratio did not change substantially for each country through the crisis years. This however of course says little about immediate medium term performance as the weight of social obligations on the sovereigns is increasing in still fragile macroeconomic and financial environment.

■ **Figure 10. Fiscal Balance as % of GDP in the MSCI EM**



SOURCE: WDI (2012) AND AUTHORS' CALCULATIONS.

Our analysis above is certainly only a sketch of a wide range of topics and issues affecting emerging markets' instability patterns. In the interest of space we have not emphasized some of the social negative impacts of the crisis, such as severe industrial collapse, spiking unemployment, poverty, and further extremes in income distribution across the group. One may paint even darker picture by expanding the emerging markets categorization to include more countries (e.g. European post-socialist and Latin American economies). We leave this exercise for a specialized study.

By now few facts presented here should be sufficient to see that for emerging markets, global economic transformation, most immediately visible in the financial markets instability, has led to an apparent contradiction of the individual investor's return maximization strategies and individual country's economic development strategy. Simply, following a sharp foreign exchange outflow (either due to reduced net FDI inflow or capital flight in most extreme cases) from the domestic market, sustainability of ongoing and future economic development projects, as well as, viability of banking intermediation and social stability, rise up on fiscal planners' agendas. As shown above, recent data suggests that, emerging markets, *en masse*, have probably been affected the worst due to either relatively weaker economic base of fragile industries leading to output losses and capital outflows or deeper penetrating social impacts of the global crisis with country variances. The responsibility for protecting fragile economies and financial systems – outperforming speculative financial markets as they may be – then shifts to a sovereign. It is up to the governments' proactive fiscal policy and optimally designed fiscal rules to smoothen the recessionary impacts on domestic markets. We address these questions below.

## ■ 4. Fiscal Net, Fiscal Rules, and Fiscal Superfund Under the RFU

### Fiscal Net

Conceptually the state-led intervention in the market fits within the Musgrave's (1959) fiscal trilogy – stabilization, distribution, allocation. There the primary target has been and continues to be the broader macroeconomic stabilization, which, for example, for Russia still acts as a bridge between the financial and the real components of the economy, in spite of the prevalent decoupling tendency. Several countries have followed this script and various reports and policy notes from the leading international financial and development institutions advocated proactive fiscal policy as an anti-crisis instrument (IMF Fiscal Monitor, 2012).

The key aspect signified during the recent crisis dealings has been the policymakers' determination to act on a preemptive basis. Conceptually this redefines an earlier

proposition of *fiscal net framework* as helpful in emerging economy's analysis. The original fiscal net idea is derived from an already known *fiscal diamond* (Rajaram, 2007) and explored for the two CIS country groups (net exporters and net importers) in Gevorkyan (2011).

Without replicating this earlier defined concept we allude to a blended mix of monetary and fiscal rules. However, whereas in some post-socialist economies such decisions may be falling on legacy tracks, with more modern pragmatism, elsewhere, including developed democracies (e.g. debates on “fiscal cliff” in the U.S. or coordinated policy response in the European Union) such efforts fall into a stalemate leading to unclear results. Still this administrative ability to make and execute joint economic policy may with time enrich the peculiar definition of an emerging market.

To illustrate, in the modified fiscal net environment the key components are the following:

- *FXLoans* – share of foreign currency denominated loans in the domestic market, as share of GDP (varies by country for the MSCI EM but roughly 10% in 2010).
- *Taxes* – tax revenues as share of GDP averaged at around 16% for the MSCI EM in 2010.
- *PubDebt* – central government debt as share of GDP (43.4% for the MSCI EM in 2010).
- *ExtDebt* – total (private and short-term) external debt as share of GDP (26.1% for the MSCI EM in 2010).
- *Reserves* – share of international currency reserves, as share of GDP (21% for the MSCI EM in 2010).
- *FiscExp* – estimate of total fiscal expenditure, as share of GDP (25% for the MSCI EM in 2010).
- *StateCorp* – refers to asset holders in state-corporations that are typically large players in the emerging markets setting game rules in the economy.

Data on the above indicators is aggregated from the latest publications of the IMF World Economic Outlook and World Bank's databases. It is presented here as directional estimates, given the fluid nature of most recent data points, and sufficient indicative points.

One clear approximation is the disproportion between tax revenues levels and distribution of public expenditure and debt. Coupled with access to international reserves, any additional deductions, not captured in data presented here, would contribute to the state expenditure trends.

Note that the ratio of external debt is quite high for foreign-currency dependent economies. This may be a result of high levels of foreign currency denominated debt accumulation by the private sector and financial institutions in particular. Perhaps due to burgeoning consumer societies it also refers to the finding in Gevorkyan (2012a), Mau (2009), and Fungáčová and Solanko (2008) of earlier relatively stable macroeconomic times leading to increased and more aggressive expansion of the financial sectors.

As described this framework offers a conceptually new ground for further discussion and analysis. For one it may be counterweighted by stock market and financial market disturbances, as mentioned earlier. For an outsider, it is important to realize that this is a conceptually new way of doing things. Yet, it is also an instrument addressing the redefined fundamental uncertainty concept.

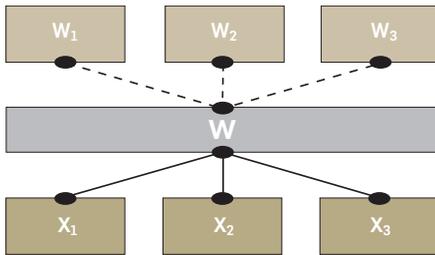
### **Fiscal Net Rules and Fiscal Superfund**

Allowing a variation of fiscal net framework, as per above, we now draft a possible scenario for fiscal rules policy guided by RFU in emerging markets. Recent research at the IMF (e.g. IMF, 2012; Schaechter *et al.*, 2012; or Budina *et al.*, 2012) offers an informative confirmation for a widespread use of fiscal rules in standalone economies and those belonging to various regional or economic clubs (e.g. EU). Accordingly, IMF (2012) define “fiscal rules ... as a longer-lasting constraints on fiscal policy through numerical limits on budgetary aggregates.”

It is the position of this paper that emerging markets, despite their effort to appear investor friendly (perhaps inspired by the 1990s transformation reforms in post-socialist Europe and rapid growth in the Asian and some Latin American economies) should seriously consider a stricter enforcement of fiscal rules in the environment of *redefined fundamental uncertainty*. This then helps balance off sharp withdrawals of critical foreign exchange from the market with business and financial planning projects, as described in Section 2 of this paper.

In a typical scenario, a responsible government in an emerging market has a set of objectives in infrastructure, education, healthcare, technology, and industrial development sectors. Each sector can be described by a preset competitive target goals and indicators custom geared for each sector. Each of these sectors (or fiscal projects) are included in the annual central government budget with an actual monetary amount of earmarked spending. The funds come from the (super) fund or sovereign wealth fund, which in turn pools revenue from multiple traditional (taxes, sovereign borrowing) and unorthodox (energy exports, international reserves, remittances, Diaspora contributions, etc.) sources. This relationship is diagrammatically described in Figure 11.

■ **Figure 11. Hypothetical Fiscal Net Pool**



Note: this is a hypothetical representation of potential revenue sources  $w_i$  pooling into (fiscal super)fund  $W$  given planned expenditures  $x_j$ .

Corresponding to the diagram in Figure 11 the basic relationship can be described in the following way. Revenue from fiscal net’s various alternative sources  $w_i$  (three shown in the diagram but many more are possible), is pooled into one (super) fund  $W$ , so that:

$$W = \sum_{i=1}^n \rho_i w_i \quad (1)$$

where individual sources  $w_i$ , for  $i=1\dots n$ , are added on a weighted scale  $\rho_i$  to comprise the total pool. In effect  $\rho_i$  is a ratio of each individual revenue source to the total pool,  $W$ , so that

$$\rho_i = \frac{w_i}{W}.$$

Once accumulated within the fund the total pool of financial resources,  $W$ , is disbursed for investment projects,  $x_j$ . Similarly then:

$$X = \sum_{j=1}^m \chi_j x_j \quad (2)$$

where individual investment projects  $x_j$ , for  $j=1\dots m$ , are added on a weighted scale  $\chi_j$  to comprise the total investment projects funding demand,  $X$  that is assumed to equal  $W$  (i.e. no additional funding is available). In a similar fashion,  $\chi_j$  is a ratio indicating proportion of each investment project within the total spend:  $\chi_j = \frac{x_j}{W}$ . It is important to clarify that:  $\rho_i \neq \chi_j$  and  $n \neq m$ .

Note that revenue sources  $w_i$  are connected with the  $W$  via dash lines suggesting volatility in the actual annual contributing balances. This volatility is subject to market conditions and above characterized fundamental uncertainty. On the other hand, each investment project  $x_j$  is linked with a solid line with the  $W$  suggesting a pre-set monetary value, included in the annual budget. Hence the fiscal rule, within this fiscal net scenario, is to dynamically adjust contributions coming from each revenue source to ensure guaranteed spending on each investment project  $x_j$ . To give this model a bit of realistic flavor, we further stipulate that each revenue source  $w_i$  may have three potential designations:

1. a preset monetary value allocated to either savings or “rainy day” fund  $c_{0i}$ ,
2. a certain percentage intended for the investment projects financing  $c_{1i}$ , and
3. the remainder  $\mu_i$  that could either be allocated to savings or used to compensate shortfall in the next alternative revenue source.

Formally this may be expressed as follows:

$$w_i = \eta_0 c_{0i} + \eta_1 c_{1i} + \mu_i \quad (3)$$

where  $\eta_0$  and  $\eta_1$  are positive coefficients corresponding to proportions of intended  $w_i$  spending. For simplicity we assume  $\eta_0=1$  and  $c_{0i}$  to be predetermined at a set monetary value (for example, \$20 billion of annual revenues from oil exports) that is allocated in the safe, “rainy day” fund and may not be spent on the development projects described by  $x_j$ . Then if for example we allow the range of  $60\% \leq \eta_1 \leq 80\%$  for the portion  $c_{1i}$  that goes directly to development projects, we should expect anywhere from 60 to 80 percent of the specific source’s revenue (e.g. oil exports) to go as contribution to the  $W$  fund.

With the “rainy day” fund parameter determined in absolute values, the above logic potentially leaves the remainder  $\mu_i$  that in turn if significant may go directly to  $W$  or (due to the dashed lines) compensate potential shortage from another fund. In other words, between hypothetical revenue sources designated as  $a$ ,  $b$ , and  $c$  the true income that would be allocated to investment in development projects within fiscal net framework would be determined by expression:

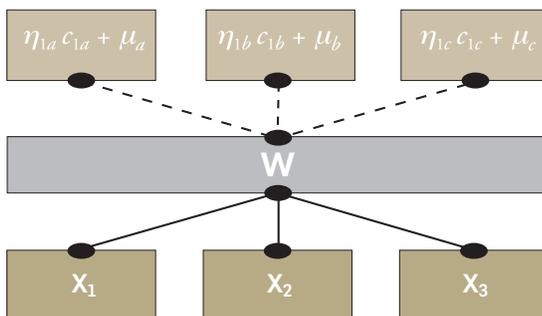
$$\text{From revenue source a: } \eta_{1a} c_{1a} + \mu_a \quad (4a)$$

$$\text{From revenue source b: } \eta_{1b} c_{1b} + \mu_b \quad (4b)$$

$$\text{From revenue source c: } \eta_{1c} c_{1c} + \mu_c \quad (4c)$$

Graphically this then requires an adjustment to the earlier diagram and is shown in Figure 11 A.

■ **Figure 11 A. Hypothetical Fiscal Net Pool with Adjusted Revenue Sources Definitions**



Note: this is a hypothetical representation of potential revenue sources  $w_i$  pooling into (super) fund  $W$  given planned expenditures  $x_j$ .

The above described set up allows for a multitude of add-on assumptions and rules to be built around it. To keep the exposition straightforward for now, we first note that coefficients  $\eta_0$  and  $\eta_1$  may have pre-assigned values, which would drive the dynamics differently but also eliminate the  $\mu_t$  factor. Still this would not prevent the sovereign to effectively manage the funds and compensate a shortfall in revenue from source *a* by directing or adjusting allocations based on source *b*. For example, between international reserves and revenue from energy products, a prolonged decline in prices of oil would result in reduced revenues from energy exports. But the (assumed) stockpiles of international reserves would provide the cushion to cover that gap, at least temporarily until either prices recover to sustainable levels or other competitive improvements take place. Of course, with the income options laid out as in (4a), (4b), (4c) above there is a potential to evaluate each revenue source against other alternatives for significance and reliability in the process of devising the fiscal net at a macro level.

Conceptually the decision process described above fits within the existent fiscal rules structure (IMF, 2012). Most of the economies in our sample have instituted operational rules aimed primarily at keeping fiscal balance, which leads in many cases to a pro-cyclical fiscal policy. Brazil, according to IMF (2012), has operated according to the 2000 rules that impose strict sanctions on local governments not compliant with the “golden rule” principle, i.e. new borrowing cannot exceed public investment. On the other hand, in the wake of the crisis Russia removed its long-term non-oil budget deficit target of 4.7 percent of GDP in favor of allowing larger variation in fiscal spending, including anti-crisis measures.

Examples are many, and it is not the aim to cover all in this study. The framework of RFU and fiscal net is characteristic of the modern emerging market’s paradigm and in our view needs research and pragmatic analysis of its rational use. For a typical investor though, weighing risks of entering or returning into the emerging market this must also represent a much more reasonable decision, given each country’s uniqueness and policy adaptability under uncertain conditions to maintain economic stability. That policy adaptability is exemplified in our analysis by the fixed earmarked funding of key development projects but more flexible revenue sourcing. In the next section we try to merge the above discussion with a dynamic optimal constraint model.

## ■ 5. Optimal Fiscal Policy Model with Rules and under RFU

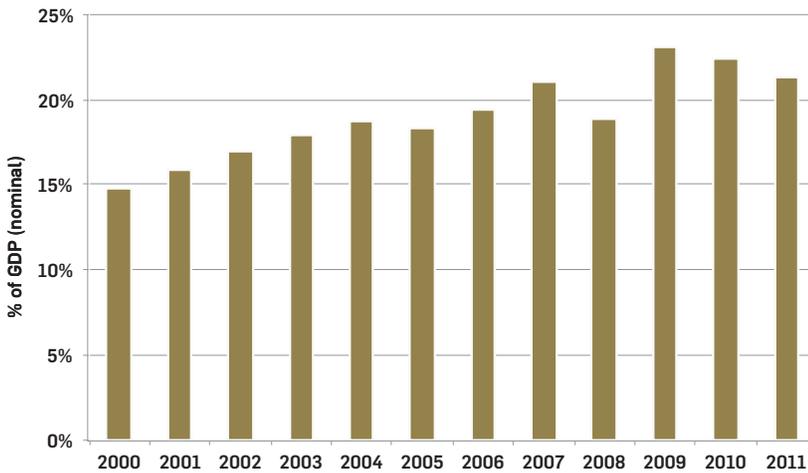
As a footnote we emphasize that it has become standard to apply a “Bohn-test” (e.g. Bohn , 1998 and 2005) in studying fiscal sustainability trends (e.g. Mendoza and Ostry (2008), Greiner *et al.*, 2005, and Gevorkyan, 2012b and 2011). The “Bohn-test” suggests that even facing uncertainty, a government can increase its

borrowing and still achieve solvency. In econometric terms, one way of conducting such a sustainability test is by looking at the primary surplus response to changes in debt-income ratio. The debt to GDP ratio coefficient should be positive.

However that analysis, while insightful and needed, relies primarily on the economy's ability to tap into capital markets to raise new funds. The recent crisis has redefined this paradigm when even several member-states of the European Monetary Union are incapable of attracting sufficient funds at competitive sovereign spread levels. Clearly, emerging markets, with implied risk, structurally weaker economic base, and volatility discussed above, are at disadvantage.

The unorthodox solution that emerging markets have followed during and immediately after the crisis has been to rely on international reserves to avoid sharp currency depreciation and compensating for foreign exchange liquidity outflow. We have included that as a component of the fiscal superfund,  $W$ , in the above depiction. Here Figure 12 plots the evolution of reserves for the MSCI EM group in our sample as a share of GDP.

■ **Figure 12. Total FX Reserves (Less Gold) to GDP Ratio (Nominal)**



SOURCE: WDI (2012) AND AUTHORS' CALCULATIONS.

On average for the group the data shows higher levels of reserves to GDP right after the crisis, shifting to a declining trend post 2009. This cycle seems to be consistent with 1) initial defensive actions by emerging markets in 2008; 2) revamped foreign investors' interest and investment in the group starting 2009 via portfolio allocations and currency appreciation; and 3) decline in emerging markets' opportunities due to increasing risk and overall damp macroeconomic environment. Recent examples of reserves usage and optimal fiscal policy application may be found in Gevorkyan (2011) and Zhou (2009).

The other story evident from Figure 12 is less complex. Namely, an emerging market cannot treat any source of its revenue (or formally, reserve foreign exchange) as a given. It is dynamic, fluid, and subject to abrupt change and volatility. Hence, it is only a component in the  $W$  superfund. These (super)funds hold an implied earmarked strategic fiscal spending outside of static policy stabilization mandate. Then with a national development concept promoting infrastructure investment, innovation, and knowledge base re-design it is technically possible to dynamically adjust financial inflows even facing the inherent financial and economic uncertainty that is also implied by fluctuations in revenue contribution from each non-traditional revenue source.

In a hypothetical theoretical model we may think of a fiscal planner trying to maximize fiscal consumption ( $G$ ) and level of superfund ( $W$ ) as a share of GDP subject to three constraints: on total capital growth ( $K$ ), central government debt ( $B$ ), and level of international reserves ( $R$ ). While other constraints are realistically possible, we limit our description of the economy without loss of generality to those variables. In more formal terms the maximization problem can be described as:

$$\max_{c, w} \int_0^{\infty} e^{-(\rho-n)t} \left( \frac{(c(\tau w)^{\gamma})^{1-\sigma}}{1-\sigma} - 1 \right) dt \quad (5)$$

where  $w$  is the fiscal superfund as a share to GDP;  $\tau$  is a share of total fiscal resources available for discretionary spending—this would be the component that contributes to the  $W$  accumulation—the weight of public consumption in the economy is then given by  $\gamma$  and total government spending,  $c$ , as GDP share. Other variables are discount factor,  $\rho$  and scale factor,  $\sigma$ . In its basic construct our model is reminiscent of similar fiscal policy and monetary policy optimization models found in Semmler *et al.* (2011), Kato *et al.* (2009), Gevorkyan (2011), and others. Following that methodology we assume a separable utility function  $U(\cdot) = \ln c + \gamma \ln(\tau w)$

The above maximization problem is constrained by

$$\dot{k} = k^{\alpha} - c - (\delta + n)k \quad (6)$$

$$\dot{b} = (r - n)b - (1 - n)w \quad (7)$$

where equation (6) describes evolution of capital (a generic application of this model may further specify the physical and human capital components) dependent on investment shares in the economy,  $\alpha$ , government spending,  $c$ , and offset by standard depreciation,  $\delta$ , and population,  $n$ , growth factors. In this presentation the  $k^{\alpha}$  term implicitly accounts for investment cycle evolution in relation to own determinants, e.g. interest rate.

Equation (7) refers to sovereign debt evolution being constrained by the real borrowing rate,  $r$ , population growth,  $n$ , and offset by accumulation levels in the fiscal superfund,  $W$ . Note that population growth enters in both (6) and (7) as a smoothing component. Specifically, in equation (7) it refers to the fact that any spending outside of standard ( $G - T$ ) balance, i.e. coming out  $W$ , is scaled by population growth.

For specificity, this model can be further enhanced by adding constraints on reserves and exchange rate evolution (adapted from Gevorkyan, 2011):

$$\dot{R} = X(e^e) + F(e^e, R) \quad (8)$$

$$\dot{e} = i - i^f - \vartheta(i - i^f, R) \quad (9)$$

where in (8)  $X(e^e)$  are net exports dependent on real exchange rate and  $F(e^e, R)$  is the net inflow of financial assets that contributes to foreign exchange accumulation. Finally, in (9)  $(i - i^f)$  can be thought of domestic Credit Default Swap (CDS) spread with  $i$  as domestic and  $i^f$  foreign returns on financial assets denominated in respective currencies. This is offset by a domestic risk factor,  $\vartheta$ , that accounts for CDS spread and reserves levels,  $R$ . Note that we are keeping  $r$  and  $i$ , and  $i^f$  defined separately for this general model.

Solution to the core model, without getting into technicalities of  $c$  and  $w$  definitions, can be derived from solving a current value Hamiltonian problem such as:

$$H = lnc + \gamma \ln(\tau w) + q_1 [k^\alpha - c - (\delta + n)k] + q_2 [(r - n)b - (1 - n)w] \quad (10)$$

with co-state variables defined as  $q_1$  and  $q_2$ . The first order conditions for the two choice variables are:

$$\frac{\partial H}{\partial c} = 0 \rightarrow c^{-1} = q_1 \quad (11)$$

$$\frac{\partial H}{\partial w} = 0 \rightarrow \gamma w^{-1} = -q_2(1 - n) \quad (12)$$

And for the two co-state variables

$$\dot{q}_1 = q_1(\rho - n) - \frac{\partial H}{\partial k} = q_1(\rho - n) - q_1[\alpha k^{\alpha-1} - (\delta + n)] \quad (13)$$

$$\dot{q}_2 = q_2(\rho - n) - \frac{\partial H}{\partial b} = q_2(\rho - n) - q_2[(r - n) - (1 - n)w] \quad (14)$$

From here on we can set equation (11) and (12) in the form of

$$q_1 - c^{-1} = 0 \quad (11a)$$

$$\gamma w^{-1} + q_2(1 - n) = 0 \quad (12a)$$

Setting differential equations (6) and (7) and (11a), (12a), (13), and (14) to zero it is then possible to solve for optimal stationary state  $\{c^*, w^*, k^*, b^*, q_1^*, q_2^*\}$ . The exercise can further be extended to achieve an optimal per capita income result and modified for additional considerations on exchange rate and foreign reserves.

The typical solution, with some parameterization, would then lead to a steady state condition with optimal distribution of all involved components without much variation. However, in this paper we follow up on this technique by offering a more technically challenging solution based on the *Nonlinear Model Predictive Control* (NMPC). The main reason for that is our interest in developing some general scenarios in the emerging markets space that later may be customized in a more focused country or region-specific study.

## ■ 6. RFU and Scenarios for Post-crisis Emerging Economies

The NMPC method as explored in Grune and Pannek (2011) offers much more flexibility allowing us to detect a balancing tendency across chosen parameters early on. It is an optimization based method which determines the feedback control of nonlinear systems. Here we develop a simplified adaptation of the method relevant to our overall theoretical model described above. All estimations for this method were done in MATLAB.

Following NMPC algorithm, at each sampling instant future behavior is optimized over a finite time horizon, in our case  $t=10$  years. Then the first element of the resulting optimal control sequence is used as a feedback control value for the next sampling interval. The algorithm appears to be accounting well for the specified control and state constraints in our model (on capital,  $k$ , and debt,  $b$ , evolution and superfund shares,  $w$ ). Technically, in many cases one-step experiment is sufficient and each subsequent change is based on preceding situation.

This methodology seems to be apt for and fitting our earlier discussion of fiscal rules and RFU in the emerging markets. In setting up NMPC model we rely on capital and debt stock evolution equations (6) and (7) as primary controls to our maximization problem in (5). In effect we are following the steps involved in solution of (10) with an important deviation to allow nonlinear feedback in capital and debt accumulation in the overall model.

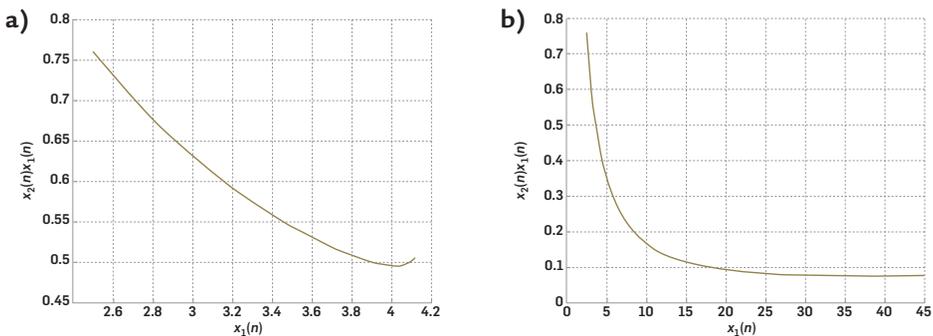
Using a range of values from the MSCI EM index (based on WDI, 2012 data aggregation) we hypothesize three equilibrium scenarios as seen in Figure 13 (a, b, c). The three diagrams reflect variation in sustainable sovereign debt to capital ratios

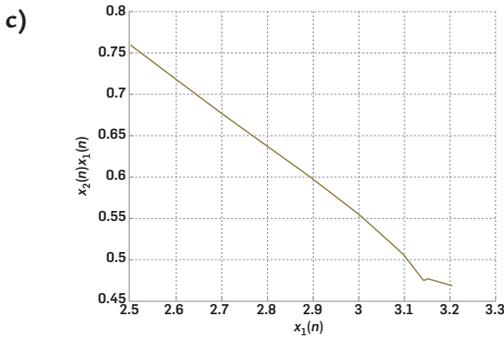
in relation to emerging markets capital accumulation. In all three cases it is evident that initial stages, with a guaranteed GDP share of  $w$  (recall that this is a compilation of various revenue sources including reserves) debt levels are significantly higher as country's capital stock remains in early formation.

As capital stock grows, even adding more debt lowers the  $b/k$  ratio as capital formation outpaces debt accumulation in the background of guaranteed  $W$  and fiscal planners' ability to backstop any foreign exchange outflow. Table 1 provides a summary of key parameters utilized in our NMPC model. The key variable elements are our assumptions for shares of:  $\tau$ ,  $w$ ,  $r$ , but also the  $\alpha$ . Our calibration of the latter term suggests varying significance of physical capital accumulation (or by extension national level of savings,  $s$ , in a representative system). This reconnects with our initial discussion on the diversity of emerging markets definitions per se.

It is evident that of the three, scenario (b) appears to lead to a more sustainable path. One might further extend this to a case of exchange and output, given many of emerging markets' export orientation and significant role of state in industrial policy. An adaptation from Gevorkyan (2011) appears in Figure 14 where demand curve GG (characterized by an open economy IS equation) and a financial markets curve AA'. Suppose an economy starts at point  $E_0$  corresponding to natural output level  $Y_0$  and competitive exchange rate level of  $e_0$  (expressed as units of domestic currency for foreign currency). With deteriorating external position and as access to credit dries up real output shrinks (expressed in a leftward shift) and economy enters a period of recession.

■ **Figure 13. Three Scenarios of Capital and Sovereign Debt Balance in Emerging Markets**





Note: that  $x(1)$  is capital,  $k$  and  $(x2)$  is sovereign debt,  $b$ , to GDP ratios.

SOURCE: AUTHORS' CALCULATIONS BASED ON NMPC SIMULATIONS. ACTUAL MODEL AND PARAMETER ESTIMATES ARE AVAILABLE FROM THE AUTHORS UPON REQUEST, SUBJECT TO NON-DISTRIBUTION AGREEMENT.

As crisis develops transforming the economy, liquidity leaves as in most emerging markets. This prompts risk premiums on foreign, private and public debts, in particular foreign currency denominated loans, to rise as foreign investors demand higher returns associated with their generic perception of the specific market. There is imminent pressure on domestic currencies for drastic depreciation, or forced devaluation. This may be accompanied by a reduction in net exports and risks of high inflation.

At the same time sustainable levels of foreign, domestic private and public debts decline—a somewhat contrary finding to our NMPC approximation above. This then evokes blended fiscal and monetary authorities' decisions, via fiscal net. Central bank follows extended Taylor-type monetary policy rules, and fiscal authorities watch over the levels of sustainable debt (including large semi-private corporations' exposure to debt, as discussed in the fiscal net framework).

● **Table 1. NMPC Parameterization in the Emerging Markets Model with Superfund,  $\mathcal{W}$**

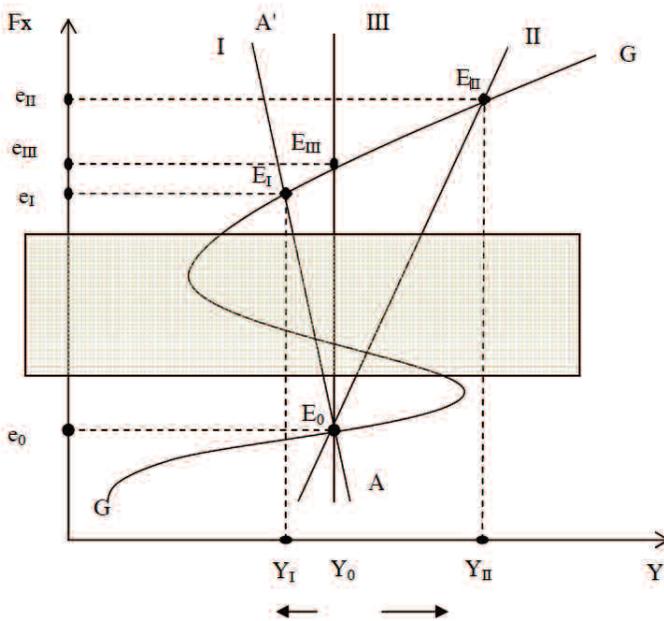
Parameters	Scenario a	Scenario b	Scenario c
$\delta$	0.3	0.35	0.3
$k$	2.0	2.0	2.0
$b$	0.0117188	0.0117188	0.0117188
$n$	0.02	0.04	0.05
$\alpha$	0.2	0.8	0.1
$\tau$	0.75	0.25	0.65
$w$	0.02	0.25	0.25
$R$	0.01	0.1	0.02

As mentioned earlier there may be two approaches out of this situation: a) if available, large foreign exchange reserves stockpiles may be relied on to prevent sharp currency depreciation and throw some liquidity in the markets in the short run; b) limited reserves and/or inability to quickly raise capital (e.g. some emerging economies are considering appealing to their expatriate communities) leads to sharp currency depreciation and unclear macroeconomic outcomes following Figure 14.

One can hypothesize on at least three post-crisis medium term scenarios with three distinct outcomes. In all three cases we expect exchange rate deterioration (Krugman, 2000, refers to this as increased price of reserves):

- **Scenario I:** following unstable development pattern during the crisis (shaded area) economy ends up at point  $E_I$  with reduced (or below target) output level  $Y_I$  and depreciating exchange rate at  $e_I$ . There is no guarantee of returning to the pre-crisis foreign exchange reserves level. In addition there would be a significant scale back in economic activity and a further intensified decoupling of the financial sector from real.
- **Scenario II:** following unstable development pattern during the crisis (shaded area) economy ends up at point  $E_{II}$  with output growing above the pre-crisis level to  $Y_{II}$  and exchange rate depreciating even further,  $e_{II}$ . According to this scenario there is a chance for an economy to not only regain its productive capacity but also restore and increase its currency reserves stockpiles. This would be characteristic of the pragmatic allocation of available reserves and adherence to strict discipline in accumulation and spending.
- **Scenario III:** following unstable development pattern during the crisis (shaded area) economy ends up at point  $E_{III}$  with output at the pre-crisis level to  $Y_0$  and exchange rate depreciating to the level  $e_{III}$  (between Scenarios I and II exchange rates). Accordingly, it is safe to assume that an economy restores its productive capacity and pre-crisis foreign exchange reserves stockpile. This is likely only in the case of explicit reserves target ( $R^*$ ), which if set too-high given economy's real capacity adversely affects on debt sustainability.

■ Figure 14. Possible Post-crisis Scenarios in Emerging Markets



SOURCE: ADAPTED FROM GEVORKYAN (2011).

The future at this point is not only dependent on specific country risks but is linked to occurrences across the global landscape irrespective of a country group. Given financial capital’s high mobility and relatively significant openness the emerging economies, preventing the second crisis blow, which may again come from the developed world as the advanced economies enter the period of jobless growth, may further deteriorate economy’s capacity to absorb such impact.

While emerging economies’ public finances are in fluid state, economic diversification and push for technological innovation seem to be high on the agenda. Logically these initiatives have strong potential of being long-term substitutes to current fiscal backstop even with fiscal superfund,  $W$ , condition. That gives hope for Scenarios II or III in the medium term.

Yet, Scenario II in Figure 14 represents a possible best case scenario all considered. Provided competitive economies and resisting the lure of easy foreign capital, sequential exchange rate depreciation may help restoring economies to pre-crisis output levels. Having clearly identified reserves targets ( $R^*$ ) then proves as a beneficial strategy controlling for various aspects of the economy including borrowing. But a

lot depends on the relative value of the  $W^*$  and  $R^*$  chosen. For example, setting too high a reserves targets lowers the sustainable debt-to-output ratios and the value of foreign currency denominated debt explodes with domestic currency depreciation based on our simulations. That comes from macroeconomic and political economy considerations in the emerging markets, where economic is also social. Therefore any policy decision must be evaluated from both its pure financial effectiveness and its immediate social repercussions.

It is clear that emerging markets represent a new group of economies with uncharacteristically strong potential. There are numerous problems of course, and declining labor force either due to high mortality or lack of skilled workers or outward migration (e.g. UN DESA 2006) is just one example. More worrisome is the immediate impact of the financial and real sectors decoupling in the maturing economies. Again the RFU plays a role and a lot would depend on the monetary and fiscal authorities resolve to control the decoupling process. These measures could range from technical bank controls, e.g. capital controls, audits and other control mechanisms for commercial banks' lending and borrowing practices, to more popular measures, such as setting mortgage rates ceilings for banks that have relied on fiscal stimulus and exchange rate controls.

In the end we are left with three medium term scenarios, with current data and economic policy suggesting Scenario II with potential modest growth in the near future. This clearly hinges on the assumption that our simulation of sovereign debt and capital evolution with an optimistic target for  $W$  holds, albeit to varying degrees by country. Unfortunately for emerging markets, if investors perceive rising risks we may see sharp variations in capital flows as in the late 2008 and part of 2009, which at this point might overstrain the economy. Even a positive impact, if by some miracle things improve significantly offering competitive yields, there may be problems with absorption of foreign exchange inflow without exchange rate appreciation. This again emphasizes the RFU of the emerging markets' finance, despite their yet largely untapped economic potential.

## ■ 7. Conclusion

This paper tackles the issue of post crisis emerging markets' growth model and stability under conditions of global redefined fundamental uncertainty. Reference to the classics of economic literature is a must, just like data analysis with a focus on unorthodox measures of macroeconomic performance, which this paper offers. Building an argument for a fiscal rules governed fiscal net with dominant fiscal superfund this paper simulates optimal fiscal policy and hypothetical scenarios in

post-crisis emerging markets. Results call for a prompt and proactive economic policy to equally prevent problems of sudden foreign exchange outflow (and negative impact on domestic business and social environment) and uncontrolled speculative inflow leading to problems of capacity absorption and a variation of a Dutch disease.

This then calls for fiscal policy sustainability evaluation and introduction of basic fiscal rules within the context of RFU. Resource pooling and identification of immediate key development incentives requires dynamic and adaptive fiscal level decision making. A lot depends on the global financial environment and investors' perception of risk. In the meantime emerging markets, at the minimum of this paper's sample group, are wise to pursue industrial diversification, technological advancement and investing in infrastructure projects. Therefore any macroeconomic stabilization policy that is short-term oriented would be inefficient in getting economies on a sustainable and socially rewarding medium term trend. The new normal of the post-crisis environment and the *redefined fundamental uncertainty* dictate a critical reevaluation of fiscal revenue sources and economic policy imperatives.

It would be erroneous to pass any numerical predictions on output growth or financial returns at this point. Investors must be aware of such risks and policymakers need to act today with a forward looking sustainable policy measures. It appears that any type of blended monetary and fiscal policy decision making in the medium term has to be conducted within the fiscal net framework as all encompassing. In that regard this paper is an early sketch that can be further elaborated with more specifics accounting for potentially new policy needs and revenue sources.

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