Essays on Development Economics

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Abstract

This thesis consists of four essays in empirical development economics. The first three essays focus on macroeconomic topics, examining issues related to the business cycle, fiscal and monetary policy, whereas the last one is focusing on a microeconomic topic, namely the relationship between schooling and child labor.

The first contribution investigates the effectiveness of macroeconomic policies in the recoveries periods in the Middle East, North Africa and Pakistan (MENAP). It is found that fiscal policy played a key role during the recoveries to potential output, although with weaker effects for the countries in the region that are more open to trade; monetary policy is found to have been less effective. The second essay explores the effects of the Medium-Term Expenditure Framework (MTEF) adoption on the main fiscal performance indicators, finding a positive and encouraging impact on fiscal discipline, allocative efficiency and technical efficiency, although the last one is not always robust. The third essay aims at identify the nexus between the excess of liquidity and commodity prices; in particular, it assesses whether the commodity prices react more powerfully than the consumer goods' prices to changes in real money balances. The results show a positive relationship between real money and real commodity prices and provide empirical evidence for a stronger response of commodity prices with respect to consumer goods' prices.

The last essay investigates the determinants of primary school enrollment, attendance and child labor in Bolivia, with a special attention at identifying the substitution and complementary relationships between schooling and working. The empirical findings reveal that the increase in enrollment is led by indigenous children and those living in urban areas. Moreover, contrary to common belief, being extremely poor and indigenous are the main determinants of school

attendance; while extremely poor children increased their school attendance, they were not able to reduce child labor. On the other hand, indigenous children made them substitutes increasing schooling and reducing child labor.

Different econometric techniques have been used, among which Ordinary Least Squares, Fixed Effects, Instrumental Variables, Generalized Methods of Moments estimations, Stochastic Frontier Analysis, Cointegrated Vector Autoregression and Multivariate Probit models.

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Introduction

This thesis consists of four essays in empirical development economics. The first three essays focus on macroeconomic topics, examining issues related to the business cycle, fiscal and monetary policy, whereas the last one is focusing on a microeconomic topic, namely the relationship between schooling and child labor.

This introduction elaborates on the motivations underlying the four essays and states the research questions for each of them. Also, it explains how the chapters contribute to the literature on the relative topic. Thus, the introduction starts with the effectiveness of macroeconomic policies in the recovery phases for the MENAP countries, goes through the analysis of the impacts of the MTEF adoption on fiscal performance indicators and the investigation of the nexus among real money balances and commodity prices and consumer goods' prices, and concludes with the identification of the determinants and the dynamics of schooling and child labor in Bolivia.

The recent global economic and financial crisis also affected countries in the MENAP region. Given the limited integration with global capital markets and positive spillovers from the region's oil exporters, the slowdown in MENAP countries has been somewhat less severe than in many other regions. While growth in the MENAP countries is expected to improve as the world economy begins to recover, it has been heavily debated what role countries' policies can play to strengthen the extent to which they recover in line with the rest of the world. Thus, the first chapter of the thesis examines the factors that have helped stimulate recoveries in MENAP countries. In particular, it investigates the role of countercyclical fiscal and monetary policies.

Earlier research on recessions and recoveries has focused on the determinants of recoveries from recessions caused by specific events such as currency crises or banking crises, or

examined recoveries in other groups of countries and region, however none of the previous studies undertakes an examination of the effects of macroeconomic policies on recoveries in MENAP countries *per se*. This paper makes two contributions. First, it documents the properties of output gap recessions and recoveries in MENAP countries which were not covered in earlier studies. In particular, the analysis of hydrocarbon-exporting MENAP countries is tailored to properly take into account the effect of hydrocarbon prices and production on economic activity and fiscal space. Recessions and recoveries in the hydrocarbon and non-hydrocarbon exporting MENAP countries are examined because their economic cycles have been shown to be closely linked. Second, the paper analyzes the effectiveness of macroeconomic policies, namely countercyclical fiscal and monetary policies, in the MENAP countries in stimulating recoveries. In order to do this, the paper adopts a specific methodology to identify recessions in the MENAP, namely a negative output gap relative to potential.

The analysis of the stylized facts suggests that episodes of negative non-oil output growth are quite rare in MENAP countries, and that non-hydrocarbon output growth in oil-exporting MENAP countries has on average been higher than output growth in the other MENAP countries but also more volatile. The MENAP's hydrocarbon exporters experienced more severe recessions in the 2000s than in the 1990s, possibly reflecting the downturn in the industrial countries in the aftermath of the bursting of the high-technology stock market bubble in the early 2000s and the delayed effect of the low oil prices in 1998-1999. The duration of output gap recessions increased for all MENAP countries from the 1990s to the 2000s. The duration of recoveries also increased somewhat over the two decades. The econometric analysis revealed that fiscal stimulus is associated with stronger recoveries in both groups of MENAP countries; there is also evidence that the impact of fiscal policy is weaker in countries with a higher

openness to trade in line with leakage effects. Monetary policy *per se* does not appear to have played a significant role in stimulating recoveries. Other main determinants of the strength of recoveries are the pre-recovery non-oil trade openness to GDP ratio and the public debt to GDP ratio, as well as the growth of real exports.

The second chapter builds on the observation that government finances based on an annual cycle of budget planning and implementation suffer from critical problems, as short-sightedness, because only the next year's expenditures are reviewed; overspending, because huge disbursements in future years are hidden; conservatism, because incremental changes do not open up large future vistas; and parochialism, because programs tend to be viewed in isolation rather than in comparison with their future costs in relation to expected revenue. In order to address the shortcomings of annual budgets, the World Bank and the international aid community supported the adoption of the MTEF. MTEFs translate macro-fiscal objectives and constraints into broad budget aggregates and detailed expenditure plans. When it is implemented well, spending is limited by resource availability (fiscal discipline), budget allocations reflect spending priorities (allocative efficiency), and the delivery of public goods and services is cost effective (technical efficiency).

The second essay is the first study to present large-sample empirical evidence on the MTEFs' impact on fiscal performance. Although some qualitative papers have been written about the necessary conditions that need to be in place for MTEFs to be successful, no systematic empirical evidence has been provided on the actual impacts of the MTEF on fiscal performance. In part, this reflects the lack of comprehensive data on MTEF implementation across countries. As a result, the existing literature offers limited information on which to draw lessons on past experiences.

This study aims to fill this gap in the literature by constructing a panel dataset for 181 countries over the period 1990-2008 of the three MTEF degrees of sophistication : Medium-Term Fiscal Framework (MTFF, which focuses on medium-term fiscal aggregates), Medium-Term Budgetary Framework (MTBF, which considers the allocation of aggregate spending over sectors) and Medium-Term Performance Framework (MTPF, which in addition considers performance aspects of spending). Also, it investigates the effect of each MTEF phase on the various aspects of fiscal performance: fiscal discipline, allocative efficiency and technical efficiency. Finally, the paper explores whether the MTEF impact is enhanced by the presence of an operational Fiscal Responsibility Act (FRA) or law, political cohesion, democracy, the number of IMF Missions and membership in the Organization for Economic Cooperation and Development (OECD).

Both the event study analysis and the econometric results suggest that MTEF adoption strongly improves fiscal discipline and that there is a larger effect with each successive MTEF phase. At the same time, although the event study analysis fails to provide a clear picture, the econometrics analysis reveals that MTBFs improve allocative efficiency. Finally, the MTPF seems to be the only MTEF phase that exerts a significant effect on technical efficiency, although the results are not always robust. As for the regulatory and political factors, it is found that being a member of the OECD has a favorable effect, however none of the other variables influence the effectiveness of an MTEF.

The third chapter addresses the issue of understanding the volatility of commodity prices. In the last four decades, the volatility of commodity prices generated turbulence in the global economy, affecting importing and exporting countries in opposite and vigorous ways. Nonetheless, the attention of the literature to the topic seemed to be proportional to the price

growth, with few contributions in relatively tranquil periods and more published papers when the commodities prices were back at high levels. The huge price variations of the last decade generated a renewed interest in the topic.

In the 1970s, the popular view was that commodity prices were defined as a result of the evolutions in the relevant commodity market, playing an important role in the stagflation of that decade. However, this idea has been strongly challenged. An increase in expected inflation rate due, for example, to an increase in money supply causes agents to shift from money to commodities, provoking a rise of its prices. Therefore, increases in the price of oil and other commodities could be the result of an exceeding expansionary policy, rather than an exogenous inflationary supply shock. Falling commodity prices in the 1980s and 1990s were not considered as interesting as raising prices, even though oil producers such as Mexico and Russia were experiencing important revenue losses and countries like Argentina and Brazil were suffering from low agricultural prices. After collapsing in the second half of 2008, commodity prices stabilized in early 2009 and subsequently staged a comeback. Such behavior is in contrast with what happened during past recessions. In previous global downturns, prices typically continued to fall into the early phases of recovery or rose at rates far below the increases recorded in recent months. An exception is the oil price, which recorded meaningful increases early in previous recoveries. Thus, the recent happenings of quick commodity price increases and higher volatility following easy monetary stance in the US, matched with similar accommodative policies in the euro area and Japan, led some to infer some causal role for monetary changes in driving commodity prices and ultimately inflation.

The idea of overshooting has been adapted by the literature to analyze theoretically the relationship between money, consumer prices and commodity prices. Some authors argued that

tightening monetary policy has relevant effects on commodity prices because they are flexible, whereas other goods' prices are sticky. Thus, commodity prices overshoot their new equilibrium in the short-run in order to generate an expectation of future appreciation sufficient to offset the higher interest rate. The third essay aims at identifying the nexus between the excess of liquidity in the United States and commodity prices over the 1983-2006 period. In particular, it tests whether the latter react more powerfully than the consumer goods' prices to changes in real money balances.

The results show a positive relationship between real money and real commodity prices and provide empirical evidence for a stronger response of the commodity prices with respect to the consumer goods' prices. This could imply that, if the magnitude of the reaction is due the fact that consumer goods' prices are slower to react, then, their long-run value can be predicted with the help of the commodity prices.

Finally, the last chapter of the thesis looks into an important microeconomic topic, namely the determinants and the dynamics of schooling and child labor in the Bolivian context. Bolivia remains among the three poorest countries in the western hemisphere and the poorest in South America (UNDP, 2007). According to the United Nations, achieving primary education represents a key factor for enhancing development progresses in the poorest countries. Efforts have been made to guarantee the continuous provision of universal, free-of-charge primary education. However, the fact that Bolivia has an illiteracy rate of 13 percent for people aged 15 or older confirms that the difficulties experienced by its educational system are among the most severe in Latin America (World Bank, 2008).

In order to reaffirm the commitment of the State to improve the educational system, a series of cash-transfer benefits and school feeding programs have been approved over the last 20

years. These programs are believed to be effectively contributing to higher enrollment and attendance rates, nevertheless several challenges concerning lack of homogenous implementation across municipalities and schools still need to be overcome. Likewise, with the goal of creating enabling conditions to guarantee the effective, multiethnic and non-discriminatory access to educational services, special programs have been developed to attend the needs of the vast indigenous population of the country.

Moreover, Bolivia represents a country with a high share of child labor. This share achieves about 30 percent among extremely poor families. The literature showed that child labor not only represents an exploitative activity, but it is also associated with low level of education, therefore jeopardizing human capital growth. Yet, the real issue is to better understand the determinants of child labor so as to evaluate its welfare implications. More generally, it is crucial to jointly investigate the factors driving schooling and child labor decisions.

The last essay aims at analyzing the determinants of primary school enrollment, attendance and child labor in Bolivia from 1999 to 2007, identifying how the substitution and complementary relationships among such activities evolve over time. The unprecedented use of Bolivia's national household survey MECOVI for several years allows for an in-depth historical analysis of the recent trends of schooling and child labor. Due to the lack of empirical literature on this specific issue for Bolivia, this study represents a contribution that aims at filling the gap.

Although enrollment became progressively more widespread in Bolivia, the attendance figures reveal that about 40 percent of the enrolled children did not go to school. The econometrics shows that the increase in enrollment is led by indigenous and children living in urban areas, whereas poverty and indigenous are the main characteristics driving the attendance behavior. At the same time, the proportion of working children seems not to be affected by

school incentives since extremely poor children manage to allocate their time between school and working activities (presumably reducing their leisure time), making those complements. On the contrary, indigenous children made them substitutes, increasing schooling and decreasing working. Finally, the *Bono Juancito Pinto* (BJP) scholarship implementation in 2006 had a negative effect on attendance in 2007 as possibly children tended to enroll to benefit of the first installment but they do not attend school afterwards. In addition, the BJP does not play a role in allowing children abandoning working activities.

Chapter 1: Recoveries in the Middle East, North Africa, and Pakistan: Have Macroeconomic Policies Been Effective?

Abstract

This paper identifies and documents the properties of output gap recessions and recoveries in the Middle East, North Africa, and Pakistan (MENAP) during the 1980 to 2008 period. It goes on to investigate the key determinants of the recoveries. The duration of MENAP countries' recessions and recoveries has increased from the 1990s to the 2000s. MENAP hydrocarbon exporting countries' recessions were on average more pronounced in the 2000s, and hydrocarbon importing countries' recessions milder. Fiscal policy is found to have played a key role during the recoveries to potential output, although with weaker effects for MENAP countries that are more open to trade. Monetary policy is found to have been less effective. This is likely to be related to the fact that many of the MENAP countries have fixed exchange rate regimes and hence have limited room for active monetary policy.[1]

[1] The author would like to thank Paul Cashin, Reinout de Bock, Daniel Florea, Heiko Hesse, Sam Ouliaris, Niklas Westelius, and seminar participants at the IMF Institute for insightful comments.

1. Introduction

The 2008-09 global economic and financial crisis also affected countries in the Middle East, North Africa, and Pakistan (MENAP). The growth slowdown in MENAP countries has been somewhat less severe than in many other regions, as a result of limited integration with global capital markets and positive spillovers from the region's oil exporters. While growth in the MENAP countries is expected to improve as the world economy begins to recover, it is an open question what role countries' policies can play to strengthen the extent to which they recover in line with the rest of the world.

This paper examines the factors that have helped stimulate recoveries in MENAP countries. In particular, it investigates the role of countercyclical fiscal and monetary policies. Earlier research on recessions and recoveries has focused on the determinants of recoveries from recessions caused by specific events such as currency crises or banking crises (e.g. Barro, 2001), or examined recoveries in other groups of countries (see IMF 2008a and IMF 2008b), which studied recoveries in advanced and emerging market countries, respectively) and regions, such as East Asia (Park and Lee, 2001). Cerra et al. (2009) undertakes a comprehensive examination of recoveries in a sample of 197 countries but does not analyze the effects of macroeconomic policies in MENAP countries *per se*.

This paper makes two contributions. First, it documents the properties of output gap recessions and recoveries in MENAP countries which were not covered in earlier studies. In particular, the analysis of hydrocarbon-exporting MENAP countries is tailored to properly take into account the effect of hydrocarbon prices and production on economic activity and fiscal space. Recessions and recoveries in the hydrocarbon and non-hydrocarbon exporting MENAP countries are examined because their economic cycles have been shown to be closely linked. For

instance, Ilahi and Shendy (2008) show that remittance outflows and the accumulation of financial surpluses during oil booms in the GCC oil-exporting countries are positively associated with private consumption and investments in other countries in the Middle East. Second, the paper analyzes the effectiveness of macroeconomic policies, namely countercyclical fiscal and monetary policies, in the MENAP countries in stimulating recoveries. In order to do this, the paper adopts a specific methodology to identify recessions in the MENAP, namely a negative output gap relative to potential. The focus of the analysis is on understanding the determinants of recoveries from negative output gaps. The analysis in the paper complements the analysis in Abdih et al. (2010) which documents the cyclical properties of fiscal policy in MENAP countries and shows that several MENAP countries pursued countercyclical discretionary fiscal policies in the current global crisis.

The paper identifies 59 episodes of recessions across a panel of 20 MENAP countries over the 1980-2008 period. Recessions are defined as periods where output is below potential, which is proxied by long-term trend output. For the 10 hydrocarbon-exporting countries in the panel, the empirical analysis focuses on non-hydrocarbon output growth, instead of the overall one. Production of oil and gas is mainly driven by changes in OPEC production quotas (oil) and production capacity (natural gas) and does not necessarily react to countercyclical macroeconomic policies.[2] The paper then identifies factors that are associated with recoveries of

[2] It should also be noted that fiscal space is only loosely related to current oil prices. Most oil-exporting countries implement a fiscal rule whereby the budget is based on a conservative oil price. As a result, oil price windfalls are initially saved. Higher oil prices lead to higher spending in later years to the extent that the rise in the oil price persists. In case of an economic downturn or a fall in oil prices, previous savings can be used to sustain higher spending than would otherwise be the case.

output back to its potential. Specifically, it examines the role of countercyclical monetary and fiscal policies, trade openness, export growth, and pre-recovery levels of investment, and public debt.

The statistical analysis of the paper suggests that:

- Episodes of negative non-oil output growth are quite rare in MENAP countries.
- Non-hydrocarbon output growth in oil-exporting MENAP countries has on average been higher than output growth in the other MENAP countries but also more volatile.
- The MENAP's hydrocarbon exporters experienced more severe recessions in the 2000s than in the 1990s. This likely reflects the downturn in the industrial countries in the aftermath of the bursting of the high-technology stock market bubble in the early 2000s and the delayed effect of the low oil prices in 1998-1999. By contrast, the other MENAP countries' slowdowns were milder in the 2000s reflecting improvements in their policy frameworks made since the mid-1990s. The other MENAP countries' slowdowns in the 2000s were mostly caused by spillover effects from hydrocarbon exporters in the region.
- The duration of output gap recessions increased for all MENAP countries from the 1990s to the 2000s. The duration of recoveries also increased somewhat over the two decades.
- Fiscal stimulus is associated with stronger recoveries in both groups of MENAP countries. There is also evidence that the impact of fiscal policy is weaker in countries with a higher openness to trade in line with leakage effects.

- Monetary policy *per se* does not appear to have played a significant role in stimulating recoveries. Its limited effectiveness is likely to be related to the stabilized and pegged exchange rate regimes operated by the countries in the sample which limit the scope for independent monetary policy and renders changes in money endogenous rather than a variable that policymakers can control.
- Other main determinants of the strength of recoveries are the pre-recovery non-oil trade openness to GDP ratio and the public debt to GDP ratio, as well as the growth of real exports.

The paper is organized as follows. Section 2 discusses the factors that can help spur growth after a growth recession and reviews the evidence in the literature. Section 3 explains the methodology that is used to identify episodes of growth recessions and recoveries and presents the empirical strategy that is used to examine the determinants of the recoveries. It also presents the stylized facts on the growth recession and recovery episodes, describes the data, and presents the results of the empirical estimations. Section 4 concludes.

2. Determinants Of The Strength Of Recoveries

Previous studies have related the strength of recoveries to a broad array of factors, including: proxies for fiscal and monetary policy measures taken in response to the output gap recession; indicators of initial conditions, i.e. the level of key macroeconomic variables in the year prior to the recovery such as the degree of trade openness, real domestic credit growth, the

investment to GDP ratio, the public debt to GDP ratio, and real export growth; characteristics of the output gap recession such as the amplitude and duration of the recession.

Expansionary monetary policy can be expected to stimulate recoveries. However, many MENAP countries operate stabilized or pegged exchange rates. To the extent that (full or partial) capital controls allow a degree of independent monetary policy, an increase in the supply of money is likely to be associated with lower interest rates thereby providing support to the recovery.

On balance, fiscal policy can be expected to have a positive effect on recoveries. A fiscal impulse is likely to increase output through higher consumption and investment. However, there may be adverse effects on output from an associated increase in interest rates. And a substantial part of the impulse may be diverted to increased demand for imported goods depending on the degree of trade openness, thereby limiting the effect of the fiscal impulse on the recovery. Moreover, reduced public savings associated with the fiscal impulse may be interpreted by tax payers as a signal of higher taxes in the future, thus inducing an increase in private savings, particularly if the level of government debt is high, and eventually reducing the positive effect of the fiscal impulse on private demand. Ilzetzki et al. (2009) show how countries with relatively high public debt (higher than 50 percent of GDP) and more open economies (export plus imports higher than 60 percent of GDP) have lower fiscal multipliers. The same study finds that multipliers are higher in economies with fixed exchange rate regimes, as in the Mundell-Fleming model monetary policy needs to accommodate fiscal policy, thus reinforcing the initial output effect of a fiscal expansion. The above argument would, therefore, suggest that there could be an important interaction effect between fiscal policy and the degree of trade openness. The empirical evidence on the effects of fiscal policy on recoveries is mixed. For instance, Park and

Lee (2001) find a positive significant effect of public consumption on the pace of recovery from currency crises in East-Asian countries over the 1960 to 1995 period. By contrast, Barro (2001) finds expansionary fiscal policy to have negatively affected post-crisis recoveries in the same region.

As regards indicators of initial conditions, pre-recovery export growth, a proxy for lagged world growth, is expected to have a positive effect on the strength of recoveries by increasing total demand in the economy. This effect is likely to be more muted in the event of a recession that is highly synchronized across countries, such as the current one.

Higher trade openness, proxied by the sum of non-hydrocarbon imports and exports to non-hydrocarbon GDP, can be expected to be associated with stronger recoveries. Economies that are more integrated into the world economy stand to benefit more from an acceleration of the growth of global trade which has typically grown substantially faster than global output during the past decades. Milesi-Feretti and Razin (1998) find a positive association between trade openness and output recoveries using a panel dataset of 105 developing countries from 1970 to 1996. Hong and Tornell (2005) corroborate this finding, as they detect a positive effect of higher pre-crisis openness to trade on output recoveries one year after a crisis.

A higher investment to GDP ratio in the year before the recovery can be expected to have ambiguous effects on the recovery. On the one hand, a high investment to GDP ratio in the year before the recovery can be expected to positively affect the recovery. On the other hand, a crisis associated with an investment boom can weaken the recovery by giving rise to inefficiencies in investment decisions, by raising the debt burden of the corporate sector, and by being a prelude to higher nonperforming loans. In addition, a pre-recovery investment boom may cause a contraction of investment (from positive to zero) in the next period, i.e. during the recovery

phase since there may be no need for additional investment once the desired stock of capital is obtained, thereby slowing the recovery. Indeed, for a group of 100 developing countries, Hong and Tornell (2005) find a negative effect of pre-crisis investments on output for up to three years after a crisis. However, the "sudden stops" in investment that this study finds may be less prevalent in the MENAP countries which did not experience absolute declines in real output. Higher growth of real domestic credit can be expected to have an ambiguous effect on the strength of recovery along the same lines as a higher investment to GDP ratio.

In addition to reducing the effectiveness of fiscal stimulus as discussed above, a high public debt to GDP ratio in the year before the recovery can be expected to have an independent negative effect on the strength of recovery. A heavy debt burden may act as an implicit tax on the resources generated by a country, and therefore reduce the size of domestic and foreign investments as well as their quality, raise creditors' concerns about the country's solvency, and create negative incentives for policy reforms (Corden, 1989).

The magnitude of the recession (amplitude) as well as the length of the recession (duration) can influence the growth rate during the recovery. The lower a country's level of output relative to its trend, the greater the scope for a higher subsequent growth rate as the economy rebounds to its potential growth. At the same time, the larger the output gap, the more difficult it would be for the country to close the gap in the first year. Therefore, the impact of amplitude on the recovery is ambiguous and likely to depend on the nature of the shock that caused the recession. It could be expected that longer (more persistent) recessions, for a given amplitude, would be associated with a slower recovery.

3. Empirical Analysis

3.1. Identifying Turning Points in Economic Activity

For the purposes of the empirical analysis, it is necessary to identify episodes of economic recessions and recoveries. This paper follows the "growth cycle" approach (periods of above-trend and below-trend rates of economic growth) to dating turning points rather than the "classical" approach which relies on movements in the actual level of economic activity (real GDP, see for example, Cashin and Ouliaris, 2004, and IMF, 2008a). This is done because several countries in the sample did not experience many observable declines in the level of non-hydrocarbon GDP (see Figure 2).

In order to describe the methodology to define turning points and periods between turning points, the taxonomy of Mintz (1972) is adopted as a starting point. More specifically, turning points are described as downturns and upturns, with periods between downturns and upturns (upturns and downturns) denoted as low-rate (high-rate) growth phases.[3] However, as shown in Figure 1 the procedure used in this paper deviates from Mintz (1972) by defining the recession phases as the portion of the low-rate phase in which non-hydrocarbon output is below potential —measured using the Hodrick-Prescott (HP) filter (PO in Figure 1)—by more than 0.5 percent (i.e. the output gap is less than -0.5 percent).

[Figure 1 about here]

[3] In a growing economy high-rate phases must coincide with expansions in the classical cycle, yet low-rate phases may be associated with either phase of the classical cycle.

The latter restriction is needed so as to focus the analysis only on meaningful growth slowdowns. Upturns (U) are defined as the maximum negative output gap (represented by the largest deviation of the cycle—the solid line in Figure 1—from PO) because they represent the points after which recoveries commence. The recovery phase is then defined as the portion of the high-rate phase over which the economy moves from U+1 to non-oil potential output, within plus or minus 0.5 percent.[4]

We could have defined the recovery phase as the period over which the economy reaches the next peak (D in Figure 1) from U+1--in line with classical procedures to date business cycles. However, this would capture periods where non-oil output is above potential output (positive output gaps) which could encompass other economic issues (e.g. overheating and inflation problems) that could warrant different macroeconomic policies. The amplitude of the recession is, therefore, defined as the distance between U and potential output, and its duration is the number of years of negative output gaps ending at U.

3.2. Empirical Strategy and Data

The paper studies the determinants of the strength of recoveries in MENAP countries. To this end, an empirical model which relates economic performance in the recovery phase to

[4] For the cases in which the ±0.5 percent band is not instrumental to define the end date of the recovery, the last year of the recovery is the one that minimizes the distance from the observation in the last recovery year before the lower band is reached compared with the distance from the upper band to the first year's observation that exceeds the band.

measures of countercyclical macroeconomic policies, initial conditions, and variables that control for the magnitude and length of the economic recession is estimated:

$$RecStrenght_{i,recov} = \alpha + \beta Amplitude_{recess} + \delta Duration_{recess} + \gamma MacroeconomicPolicy_{i,recess} + \lambda InitialConditions_{i,recess} + \varepsilon_i \quad (1)$$

There is no common definition of the strength of recoveries. Some studies have used the growth rate in the year after a trough or the average over a few years after a trough (e.g. Milesi-Feretti and Razin (1998), and Cerra et al. (2009). Other studies measure it as the change in output growth following a crisis (Gupta et al., 2003, and Hong and Tornell, 2005) and as the deviation of output growth from the tranquil period average (Hong and Tornell, 2005). In this paper, the strength of recovery is defined as the real non-oil GDP growth in the first year of the recovery phase (U+1) or the average growth over the whole recovery phase.

It was mentioned previously that countries' hydrocarbon output is constrained by capacity and/or Organization of Petroleum Exporting Countries (OPEC) production targets. Therefore, the relevant measure of the recoveries to potential output in hydrocarbon-exporting countries relates to non-hydrocarbon output.

A brief description of the construction of each of the explanatory variables in the regressions is given below. Data sources and variable definitions are discussed in Appendix. The key focus of the analysis is on the impact that countercyclical fiscal and monetary policies have on the recovery of growth. An important issue that needs to be tackled in this regard is the problem of endogeneity of the macroeconomic policy variables. For instance, an increase in the

fiscal deficit can contribute to higher growth. But an exogenous increase in growth could contribute to a fiscal surplus, due to the functioning of automatic stabilizers (e.g. with higher growth causing higher tax revenues and lower social safety net outlays) and discretionary countercyclical policy actions by the government. The latter effect would make it difficult to find evidence of the former effect, incorrectly leading to the conclusion that fiscal stimulus (from higher deficits) does not raise growth.

Toward this end, the pre-recovery (or lagged) values of the macroeconomic policy variables are used in the estimations. In addition to dealing with the issue of endogeneity, these variables capture that there can be a delay in the effect of a fiscal or monetary stimulus on the economy. The paper relates the growth in the first year of recovery (U+1, or the average growth in the entire recovery phase) to the lagged fiscal impulse (i.e. at U). The fiscal impulse (imp) is defined as the difference in the non-hydrocarbon fiscal balance to non-hydrocarbon potential output ratio between U and U-1.

$$imp_{1,U} = -(fb_U^{NO} - fb_{U-1}^{NO}) \quad (2)$$

where a positive fiscal impulse corresponds to a decline in the non-hydrocarbon balance. In addition, the non-hydrocarbon fiscal balance is calculated as a ratio to potential output instead of actual output at U to reduce endogeneity with the growth of output in the first year of the recovery ($(Y_{U+1}/Y_U) - 1)$). The non-hydrocarbon fiscal balance to potential output ratio is calculated as:

$$fb_t^{NO} = \frac{R_t^{NO}}{GDP_t^{NO}} \frac{Y_t^{NO}}{Y_t^{NO,P}} - \frac{G_t}{GDP_t^{NO}} \frac{Y_t^{NO}}{Y_t^{NO,P}} \quad (3)$$

where R_t^{NO}/GDP_t^{NO} and G_t/GDP_t^{NO} are, respectively, the ratios of central government non-hydrocarbon revenues and spending to non-hydrocarbon GDP (GDP^{NO}), and Y^{NO} and $Y^{NO,P}$ are the actual and potential real non-oil output.[5] In line with Cerra et al. (2009), this approach does not distinguish between a fiscal impulse resulting from discretionary fiscal policy changes and automatic stabilizers as there is no reason to assume that the latter factor would be less effective than the former to stimulate the recovery.

The growth rate of money (either nominal or real) at the upturn is used as the indicator of monetary policy.[6] However, since the majority of the countries in the sample have de facto currency board arrangements, conventional pegs to a single currency or composite basket of currencies, they have limited room for active monetary policy. Nonetheless, some national central banks could still have some autonomy in determining the spread between domestic and foreign interest rates and, therefore, in operating monetary policy in the short run, as shown in Maziad (2009) for the case of Jordan.

The initial conditions included in the baseline regression estimations are: real exports growth in the year before the recovery (U),[7] the ratio of non-oil trade to non-oil potential GDP at

[5] Potential non-oil output was calculated by applying the HP filter.

[6] Because of the limited availability of interest rate data for MENAP countries, monetary policy as deviations from a policy rule could not be measured.

[7] Real exports growth rather than real non-oil exports growth has been included because data on the volume of non-oil exports in many of the oil-exporting countries is unreliable.

U, the ratio of fixed capital formation to potential GDP at U-1,[8] and the ratio of public debt to potential GDP at U. Using the lagged values of these variable (i.e. at U) and dividing the non-oil trade by potential non-oil GDP and the fixed capital formation and public debt variables by potential overall GDP should help minimize possible endogeneity of these variables with the growth of non-oil output at U+1.

3.3. Data and Descriptive Statistics

The sample is composed of 10 hydrocarbon exporting countries and 10 other countries in the MENAP. The hydrocarbon exporters included in the sample are the six Gulf Cooperation Council (GCC) countries--Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, United Arab Emirates (UAE)--and Algeria, Iran, Libya, and Yemen. The hydrocarbon importers comprise Djibouti, Egypt, Jordan, Lebanon, Mauritania, Morocco, Pakistan, Syria, Sudan and Tunisia. The countries are divided into hydrocarbon-exporting and hydrocarbon-importing following the IMF's Middle East and Central Asia Departments May 2008 Regional Economic Outlook publication which groups the countries based on the share of oil in total exports,[9] with the exception of Sudan that has been labeled as a hydrocarbon importer because of its low levels of hydrocarbon exports over all the considered period. The sample period is from 1980 to 2008. However, data for the

[8] Information on non-oil investments is not available. The investment to GDP ratio at U-1 is used to capture the pre-recession trough level of investments.

[9] Countries are classified as hydrocarbon exporters if the share of hydrocarbon exports in total exports exceeds 50 percent. Some countries that are classified as hydrocarbon importers also export hydrocarbons (e.g. Egypt and Syria). Because data on real non-hydrocarbon GDP is not available for a sufficiently long period for these countries, total GDP is used in the analysis.

hydrocarbon exporting countries in the sample is only available from 1990 onward (with the exception of Algeria, for which data are available from 1991).

The properties of real non-hydrocarbon output growth rates (first differences of logarithms of real output) for each of the 20 countries in the sample are reported in Table 1.

[Table 1 about here]

Average growth rates of other MENAP countries (excluding Lebanon) and volatility (as measured by the standard deviation of real non-oil output) are similar to those of non-hydrocarbon exporting countries in Africa and Latin America. The hydrocarbon exporting MENAP countries, on the other hand, have had higher average non-hydrocarbon growth rates and slightly higher volatility over the 1990-2008 period compared with the hydrocarbon-importers and hydrocarbon exporting countries in other regions. Table 1 also reports the autocorrelation coefficients of the first two lags of the output growth series. The first lags are generally positive, but the second lag is negative for the MENAP hydrocarbon exporters and positive for the other countries. This suggests that shocks to the MENAP hydrocarbon exporters cycles are mean reverting while shocks to MENAP hydrocarbon importers cycles are relatively more persistent.

The standard deviation, skewness, and kurtosis of the growth cycles for the MENAP countries (filtered non-oil output series) extracted by the Hodrick-Prescott (HP), Baxter-King (BK) and Christiano-Fitzgerald (CF) filters respectively are shown in Table 2.[10]

[Table 2 about here]

On average, filtered non-hydrocarbon GDP exhibits higher volatility in the hydrocarbon-exporting countries than in the other countries, excluding Lebanon (which suffered from extensive conflicts over the sample period), irrespective of the filtering method used. The hydrocarbon importing MENA countries show negative skewness of real non-oil GDP implying larger downward spikes than upward spikes, but this disappears in the case of the BK and CF filters once Lebanon is excluded. The average skewness of hydrocarbon exporters', on the other hand, is very close to the normal distribution. The HP-filtered data suggests that average skewness for the GCC countries was also negative. The real non-oil GDP displays on average excess Kurtosis (leptokurtic distribution—with tails thicker than the normal distribution) for all the country groups, suggesting that large movements in MENAP (filtered) output are relatively common.

[10] For the HP filter the smoothing parameter, λ, has been set to 6.25. For the BK filter, Burns-Mitchell recommendations for annual data have been adopted, setting plo and phi to 2 and 8, respectively. Finally, for the CF filter, plo and phi are set again to 2 and 8.

The HP-filtered data is used to identify the turning points in economic activity. Table 3 shows the start and end dates of the recoveries by country. Because the data for the hydrocarbon-exporting countries in the sample is limited to the period from 1990 onward, the number of turning points identified is 22 compared with 37 for the hydrocarbon-importing countries in the regions.[11]

[Table 3 about here]

Figure 2 presents the HP-based output gaps and the non-oil GDP growth rates. The recovery phases are denoted by shading and the recession phases denoted by no shading in this figure.

[Figure 2 about here]

3.4. Basic Facts on Episodes of Recessions and Recoveries in the MENAP Region

Table 4 reports the average duration (in years) of the recession and recovery phases of the 59 episodes identified and the average amplitude of the aggregate phase movement in output (in

[11] It should be noted that since annual data is used, the analysis in the paper does not take into account recessions and recoveries that are completed in the same year.

percent change), and the steepness (amplitude divided by duration or the average annual amplitude) by decade (1980-1989, 1990-1999, and 2000-2008).[12]

[Table 4 about here]

The data on the median duration of recessions in real non-hydrocarbon GDP suggest that recession phases were equally as long as recovery phases for hydrocarbon importing MENAP countries in the 2000s while recovery phases tended to be shorter than recession phases in the 1990s. A typical recession and recovery in the 2000s persisted for about 2 years. The data also show that there has been a trend increase in the length of recessions and recoveries of MENAP hydrocarbon-importers. The median recession lasted 2 years for the MENAP hydrocarbon importers in the 2000s compared with 1 year in the 1980s. The median amplitude measure shows that non-oil output during recessions ranged between 3 to 4 percent below potential output for the hydrocarbon importing MENAP countries across the three decades. Interestingly, recoveries to potential output are found to have been less steep on average than recessions for the hydrocarbon-importing MENAP countries in all three decades.

The median duration of recessions in MENAP hydrocarbon-exporting countries was equal to the median duration of recoveries in the 1990s and 2000s respectively. But the duration

[12] Only four episodes are dropped if the criterion to identify a recession phase is changed to having a negative output gap that exceeds 1 percent instead of 0.5 percent. This does not alter the results on the average duration and amplitude of the recession and recovery phases.

of recessions and recoveries has increased over time for the hydrocarbon-exporting MENAP countries. The median duration of a recession was 2 years in the 2000s compared with 1 year in the 1990s. The median amplitude of the recessions was also larger for these countries in the 2000s (nearly 6 percent negative output gap) than in the 1990s (about 2 percent negative output gap). The speed with which real non-oil GDP changed in the recessions (about 2.3 percent per year) was slightly faster than in the recoveries in the 1990s (1.9 percent per year) while the opposite was true in the 2000s.

3.5. Estimation Results

Basic descriptive statistics for the data used in the regression estimations are reported in Table 5 for the 57 episodes included in the regressions for the MENAP.[13]

[Table 5 about here]

The results for the strength of recovery equations are presented in Table 6.

[13] Qatar 1995 is excluded from the sample because without it the results are substantially more robust to dropping one country at a time. Lebanon 1982 is also excluded because of fiscal data inconsistencies related to the war in that year.

[Table 6 about here]

The dependent variable in Table 6 is growth of real non-oil output in the first year of the recovery (U+1). Another set of equations are also estimated that use the growth of real non-oil output in the entire recovery phase as the dependent variable. The results are broadly the same as the results in Table 6 and are not shown here. The equations are estimated with ordinary least squares including fixed effects. The basic conditioning variables in the equations are: recession amplitude, recession duration, a measure of the fiscal impulse, real export growth, the ratio of fixed capital formation to GDP, d non-oil trade openness, and the interaction of the fiscal impulse with non-oil trade openness. A proxy for monetary policy (either real or nominal money growth) is included as a conditioning variable in the regressions in columns 1 and 2. The results of estimating the regressions including the ratio of public debt to GDP as an additional conditioning variable are reported in column 3.

The results confirm a strong and positive contribution of fiscal policy to growth during the first year of the recovery. At the same time, the interactive term between the non-oil trade openness and fiscal impulse variable is negative giving some credence to the hypothesis that a higher degree of trade openness can lead to fiscal leakage. Taking into account the interactive term and assuming the sample average degree of non-oil trade openness of 48 percent, the estimated coefficient in the column 2 regression specification implies that a 1 percent of non-oil GDP reduction in the non-hydrocarbon fiscal balance leads to a 0.25 percent increase in non-oil GDP growth. The regression results suggest that there is an independent positive effect of trade

openness on the strength of recovery. The estimated coefficient for the ratio of non-oil trade openness is significant in most of the regression specifications.

Monetary policy is found to be less important for post-crisis recovery. The coefficients on the growth of the nominal and real money supply are insignificant. A measure of the pre-recovery rate of real domestic credit growth which may be related to monetary easing is also found to be statistically insignificant (this result is not shown in the table).[14]

As regards the indicators of initial conditions, pre-recovery real export growth has a positive and significant impact on the post-recovery growth, in all the regression specifications excluding column 1 in Table 6. A 10 percentage point increase in the growth of real exports leads to a roughly 1 percentage point increase in growth in the first year of recovery. The sign of the estimated coefficient for the ratio of gross fixed capital formation to GDP depends on the regression specification but is always insignificant. The coefficient on the ratio of public debt to GDP in column 3 is negative as expected and significant. However, its effect is not significant in the regression with average growth over the entire recovery phase (not shown here).

The results suggest a statistically significant positive relationship between the recession amplitude and growth in the first year of recovery. For example, the estimated coefficients imply that a 5 percent negative output gap is associated with a 2-3.4 percentage point increase in non-

[14] Estimation of regressions that use the fraction of recovery completed in the first year (defined as $\text{ComplRec}_{U+1} = (\text{Amplitude}_U - \text{Amplitude}_{U+1})/\text{Amplitude}_U$) as the dependent variable also confirm the results shown here that fiscal policy has been effective in speeding up recoveries in the MENAP countries while monetary policy has not. These estimations suggest that a one percent increase in the fiscal impulse causes a 5 percent reduction in the output gap or a 5 percent increase in the fraction of the recovery that is completed in the first year.

oil GDP growth in the first year of recovery. This is in line with the notion that there is more scope for a growth rebound after a sharp fall of output below potential. On the other hand, the duration of the recession always shows a negative coefficient, but this is significant in only one regression, confirming that longer recessions are associated with longer recoveries.

The results are fairly robust to changes in the list of the conditioning variables and the number of observations. In particular, the results are robust to excluding the four recession episodes for which the output gap at U is between -0.5 and -1 percent and to restricting the sample period to the period from 1990 onward. The results are also robust to defining the recession (recovery) phase according to the Mintz (1972) taxonomy so that it covers the entire period from a peak (trough) in the filtered real GDP series to its trough (U, peak), instead of the period from potential output to U (from U to potential output). This only affects the construction of the recession duration and amplitude variables that are included in the regressions. The results remain broadly the same as before. Identifying recoveries based on overall output and using the growth rate of overall output in the first year of recovery instead of non-oil output for the oil-exporting MENAP countries yields weaker results on the effects of macroeconomic policies and other key determinants. This is in line with the notion that oil and gas production are determined by other factors, including production quotas and capacity.

4. Conclusions

This paper is the first to analyze the statistical properties of output gap recessions and recoveries in the MENAP countries. It is also the first to analyze the determinants of recoveries for these countries. The paper finds that episodes of negative real growth rates (negative real

non-hydrocarbon growth rates for hydrocarbon-exporting countries) have been rare for the 20 MENAP countries in the sample. However, the MENAP countries are found to have experienced periods of meaningful growth slowdowns, including in the context of the current global financial crisis. In particular, the paper establishes 59 episodes during which output in the MENAP countries was significantly below potential output during the period 1980-2008.

An examination of these episodes suggests that the features of recessions and recoveries in the MENAP countries appear to be changing. In particular, the duration of recessions and recoveries increased from the 1990s to the 2000s. This could be related to the changing nature of recessions in MENAP countries; however, its investigation is outside the scope of this paper and could be an interesting topic for future research. Hydrocarbon-exporting MENAP countries had more pronounced recessions in the 2000s than in the 1990s, but the other MENAP countries' recessions were shallower. At the same time, recoveries to potential output have typically taken longer than the time it took for growth to reach a trough in the 2000s while the opposite was true in the 1990s.

This paper investigates the factors that could help strengthen the MENAP countries' recoveries to potential output. According to our findings, countercyclical fiscal policy has helped strengthen recoveries in the MENAP countries. However, the MENAP countries that were open to trade benefited less from a fiscal expansion owing to leakage effects. At the same time, the effectiveness of monetary policy seems to have been limited, probably because of limited exchange rate flexibility. Of the other indicators of initial conditions, pre-recovery real export growth and the non-oil trade to GDP ratio appear to have had important positive effects in speeding up the recoveries, while high pre-recovery public debt had a negative effect. The pre-

recession investment to GDP ratio does not appear to have been a key factor influencing recoveries in the MENAP countries.

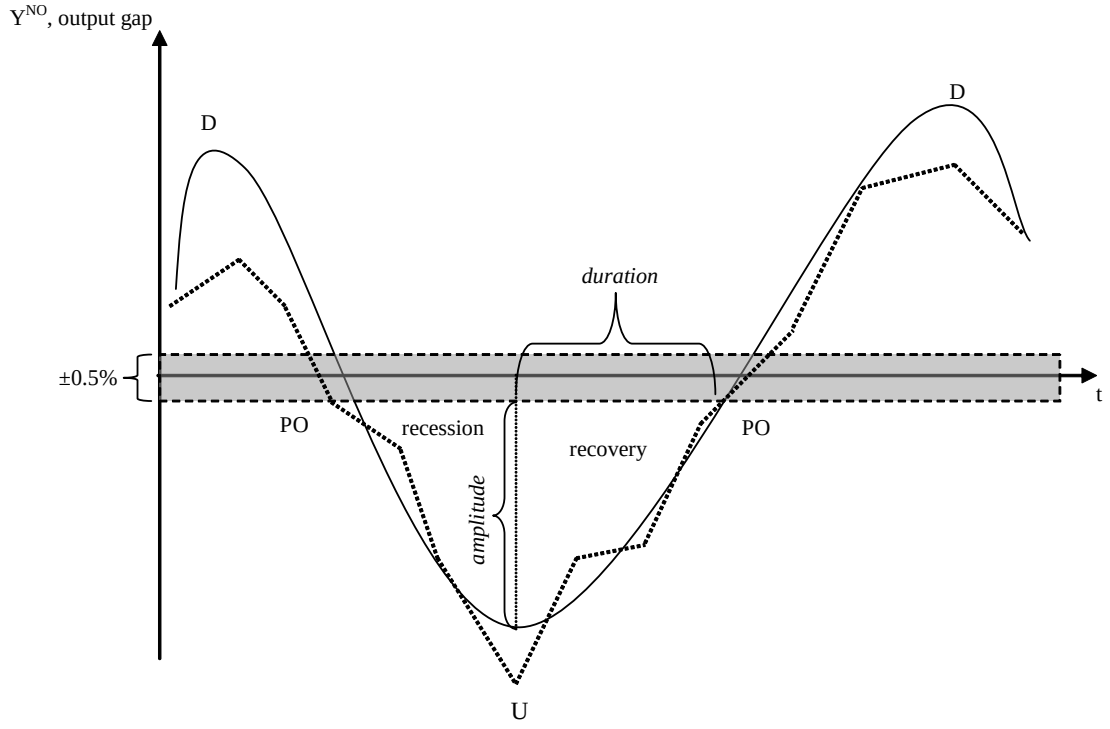
The implication of these findings would be that MENAP countries should maintain a certain level of fiscal space to pursue expansionary fiscal policy in the event of a recession as fiscal policy has proven to be an effective driver of recoveries. In view of the evidence that higher trade openness weakens the effectiveness of fiscal policy, optimization of the impact of fiscal stimulus would seem to call for targeting additional spending at items and projects with a limited import content. However, given that increased trade integration supports long-term growth, this is not in any one country's long-term interest. In fact, the importance of leakage effects underscores the need for coordination in fiscal stimulus across countries. A coordinated fiscal stimulus as called for by the IMF at the onset of the 2008-09 global financial crisis would make sure that the "leakage" in the form of enhanced demand for foreign goods and services is offset by an equivalent increase in foreign demand for domestic goods and services.

Appendix

Table A: Variables definitions and data sources

Variable	Source	Definition
Non-oil output growth	WEO and IMF country desk data	Growth rate of non-oil real GDP at U+1
Recession amplitude	Authors' calculations	Absolute value of the distance between the potential output and the cyclical component at U, calculated on the HP filtered logged non-oil real GDP
Recession duration	Authors' calculations	Number of years spent in the recession phase [PO,U], calculated on the HP filtered non-oil real GDP
Recovery duration	Authors' calculations	Number of years spent in the recovery phase [U+1,PO], calculated on the HP filtered non-oil real GDP
Recovery steepness	Authors' calculations	Amplitude at U divided by the duration of the recovery phase [U+1,PO]
Fiscal Impulse	WEO and IMF country desk data	The fiscal impulse at U is defined as the difference between the ratio of the non-oil fiscal balance to potential GDP at U and its value at U-1.
Real exports growth	WEO	Real exports growth rate at U.
Non-oil trade openness	WEO	Trade openness measured as the ratio of non-oil trade to non-oil potential GDP at U
Fixed capital formation/pot. GDP	WEO	Fixed capital formation to potential GDP at U-1
Nominal broad money growth	WEO	Growth of nominal broad money at U
Real broad money growth	WEO	Growth rate of real broad money at U. Real broad money divided by the CPI (from the WDI).
Real domestic credit growth	IFS	Growth rate of real domestic credit (domestic credit/CPI) at U. Domestic credit is line 32 from the IFS.
Public debt/pot. GDP	WEO	Central government debt to potential GDP at U.

Figure 1: Recessions and Recoveries



Notes: Non-oil real GDP growth rate Y^{NO} is denoted by the dashed line, the HP output gap is denoted by the solid line and the potential output is the zero line. The vertical axis shows the growth rates in percentages and the percentage deviations from potential output. The horizontal axis represents the time t. D stands for downturn, U stands for upturn and PO stands for potential output. The ±0.5 percent band of the potential output is denoted by shading.

Figure 2: Real Non-oil GDP Growth Rates and HP-Based Output Gaps

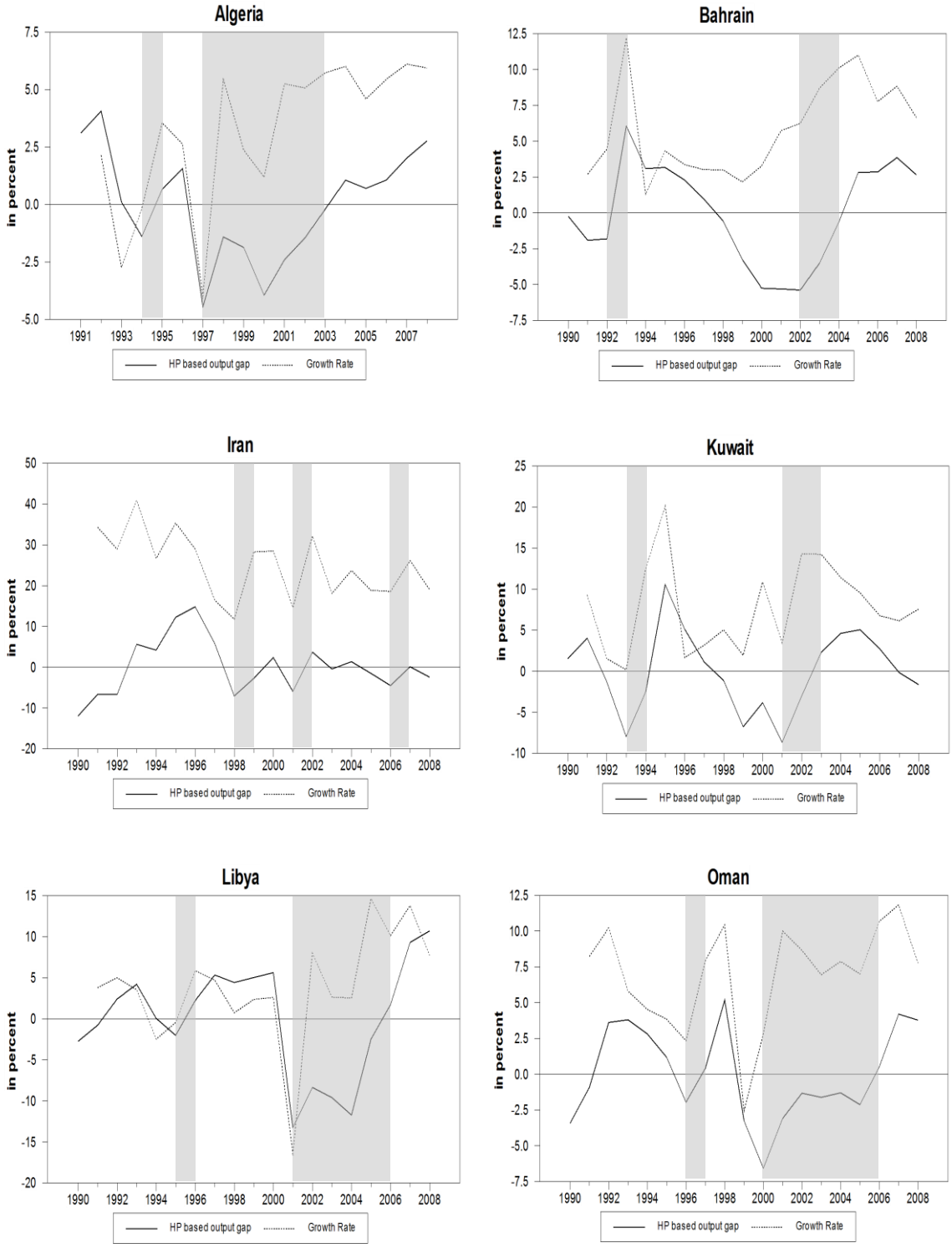


Figure 2: Real Non-oil GDP Growth Rates and HP-Based Output Gaps (continued)

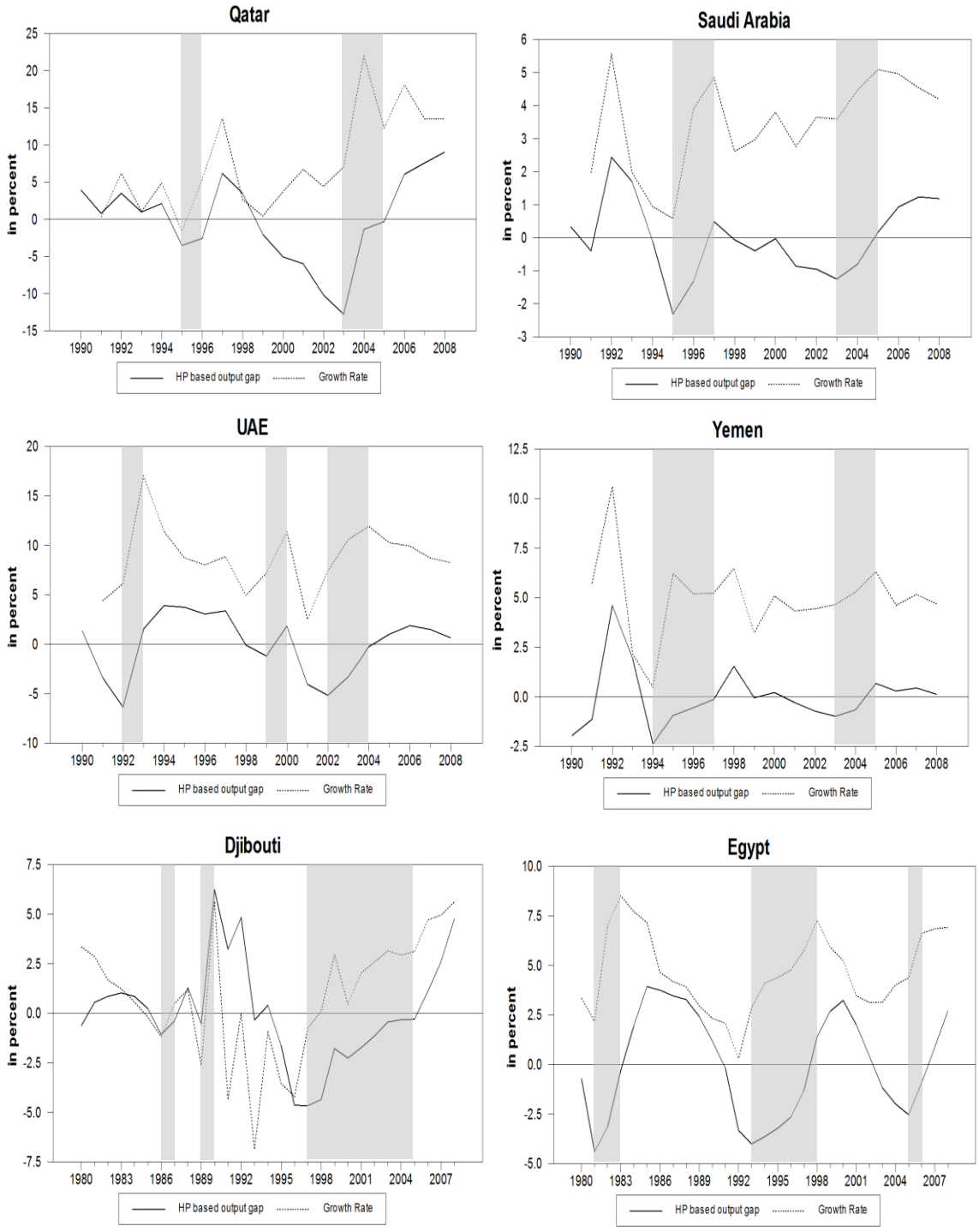


Figure 2: Real Non-oil GDP Growth Rates and HP-Based Output Gaps (continued)

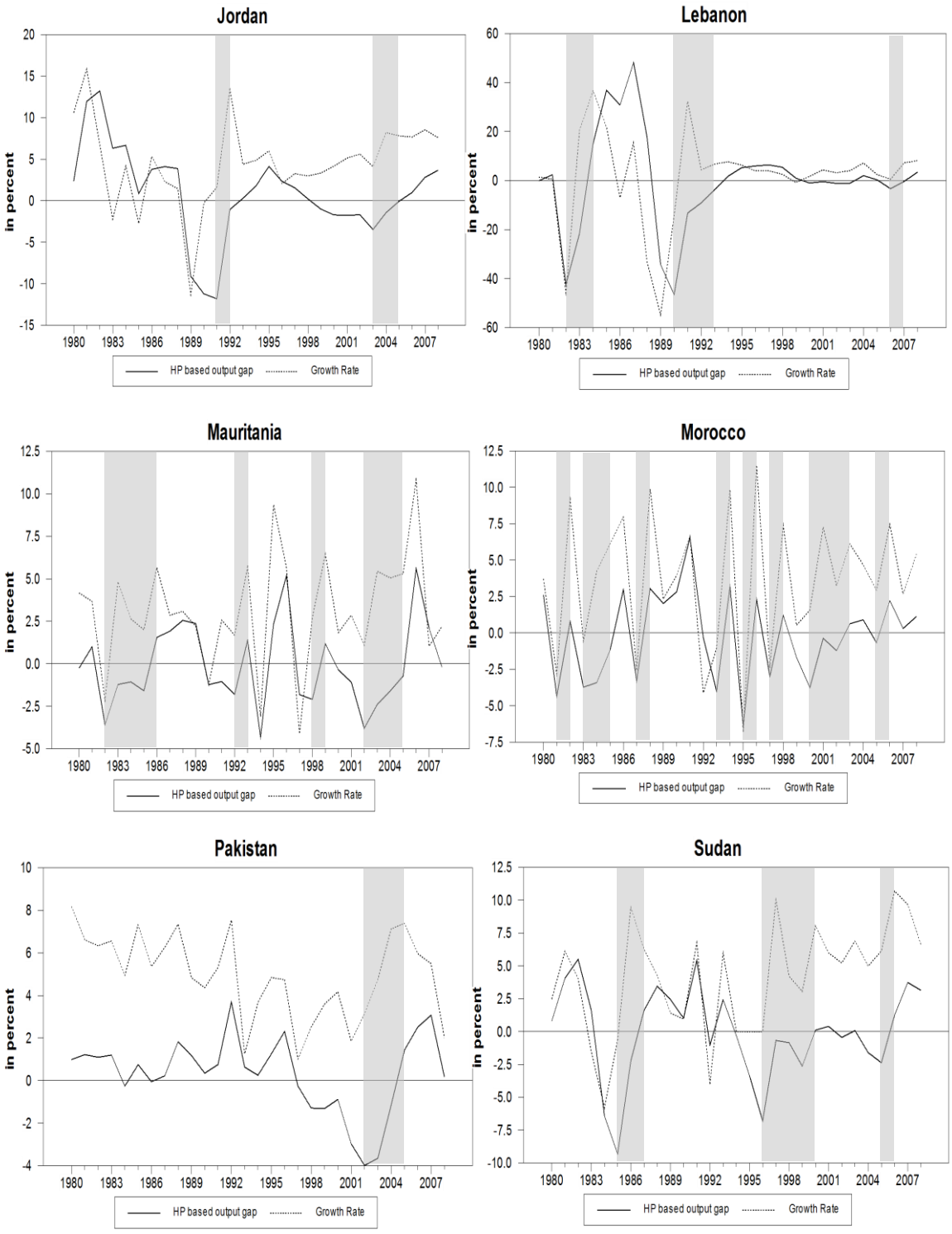


Figure 2: Real Non-oil GDP Growth Rates and HP-Based Output Gaps (continued)

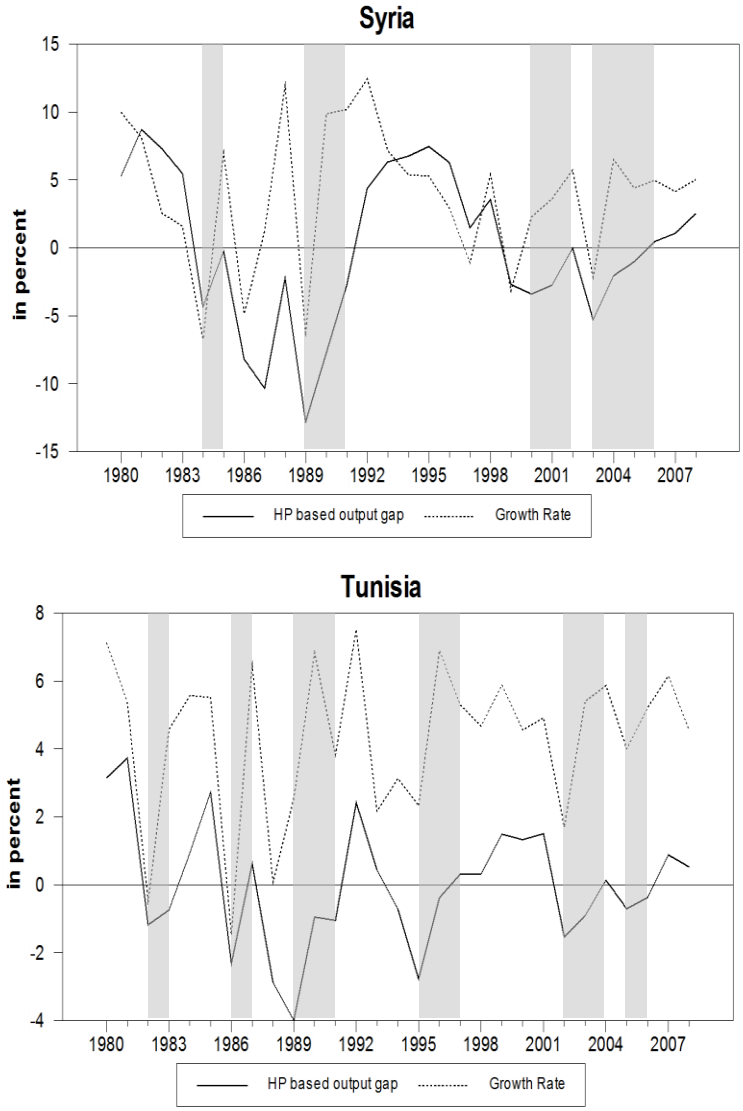


Table 1: Properties of Non-Oil Output Growth Rates

	Mean	Median	SD	Coeff of variation	Autocorr	
					1 y	2 y
1980-2008						
Nonhydrocarbon exporters in						
MENAP	3.57	4.09	5.09	1.43	0.11	0.14
Sub-Saharan Africa	3.71	4.34	5.07	1.58	0.17	0.08
Asia	5.3	5.82	3.41	0.69	0.39	0.07
Latin America	3.42	3.91	4.3	1.37	0.42	0.07
1990-2008						
Nonhydrocarbon exporters in						
MENAP	4.07	4.26	3.70	1.17	0.05	0.23
Sub-Saharan Africa	3.77	4.55	4.99	1.43	0.23	0.12
Asia	5.23	5.56	3.32	0.65	0.31	0.00
Latin America	4.11	4.45	3.3	0.88	0.4	0.1
Hydrocarbon exporters in						
MENAP	7.73	7.81	4.36	0.69	0.20	-0.02
GCC	6.70	6.38	3.95	0.58	0.25	-0.04
Other	9.27	9.95	4.97	0.87	0.12	0.02
Sub-Saharan Africa	4.96	6.61	11.40	2.88	0.46	0.20
Asia	4.91	7.07	5.71	1.17	0.45	0.13
Latin America	4.85	4.52	1.8	0.37	-0.03	-0.16

Notes: Sample moments were computed from log-differences of real output. Standard Deviation is expressed as a percentage. Coefficient of variation is the ratio of the standard deviation to the arithmetic mean. Autocorrelations of one and two years are the first and second autocorrelation coefficients, respectively. Non-hydrocarbon exporters in sub-Saharan Africa include Botswana, Ghana, Kenya, Malawi, Rwanda, Senegal and South Africa. Non-hydrocarbon exporters in Asia include India, Korea, Malaysia, Philippines and Thailand. Nonhydrocarbon exporters in Latin American include Chile, Colombia, Costa Rica, Peru and Uruguay. African hydrocarbon exporters include Angola and Nigeria. Asian hydrocarbon exporters include Indonesia and Kazakhstan. Latin American hydrocarbon exporters include Ecuador and Venezuela.

Table 2: Descriptive Statistics on Filtered Non-Oil Output

Country	Standard Deviation			Skewness			Kurosis		
	HP	BK	CF	HP	BK	CF	HP	BK	CF
1980-2008									
MENAP hydrocarbon importers									
Total	4.9	3.2	3.21	-0.16	-0.13	-0.07	0.31	0.29	0.57
Excl. Lebanon	3.21	2.04	1.92	-0.16	-0.04	0.01	0.17	0.09	0.54
1990-2008									
MENAP hydrocarbon exporters									
Total	3.92	2.63	2.22	-0.01	-0.07	0.07	0.06	0.89	1.5
GCC	3.62	2.47	2.08	-0.21	0.21	0.07	-0.4	0.91	1.69
Other	4.17	2.77	2.34	0.16	-0.3	0.07	0.45	0.87	1.35
MENAP hydrocarbon importers									
Total	3.77	2.41	2.31	-0.42	-0.37	-0.11	1.41	1.97	0.78
Excl. Lebanon	2.88	1.82	1.58	-0.11	0.02	0.09	0.25	0.37	0.17

Notes: HP denotes the Hodrick-Prescott (1980) filtered data, BK denotes the Baxter-King (1999) filtered data and CF denotes the Christiano-Fitzgerald (2003) filtered data. Standard deviation is expressed as a percentage. The skewness measure is $\mu_3/(\mu_2)^{1.5}$ and the (excess) Kurtosis measure is $\mu_4/(\mu_2)^2 - 3$, where μ_τ is the r^{th} (central) moment.

Table 3: Recovery Years (from trough (U) to potential output (PO))

MENAP hydrocarbon exporters									
Algeria	Bahrain	Iran	Kuwait	Libya	Oman	Qatar	S.Arabia	UAE	Yemen
94-95	92-93	98-99	93-94	95-96	96-97	95-96	95-97	92-93	94-97
97-03	02-04	01-02	01-03	01-06	00-06	03-05	03-05	99-00	03-05
	06-07						02-04		
MENAP hydrocarbon importers									
Djibouti	Egypt	Jordan	Leb.	Mauritania	Morocco	Pakistan	Sudan	Syria	Tunisia
-80	81-83	91-92	-80	-80	81-82	02-05	85-87	84-85	82-83
86-87	93-98	03-05	82-84	82-86	83-85		96-00	89-91	86-87
89-90	05-06		90-93	92-93	87-88		05-06	00-02	89-91
97-05			06-07	98-99	93-94			03-06	95-97
			02-05	95-96				02-04	
			00-03	97-98				05-06	

Notes: Upturns (U) and last years of recoveries (PO) of HP filtered data are reported.

Table 4: Average Duration, Amplitude, and Steepness of the Phases for Non-Oil Real GDP by Decade and Group of Countries

	1980-1989						1990-1999						2000-2008					
Country	Obs	Dur. PO-U	Dur. U-PO	Ampl. PO-U	Steep. PO-U	Steep. U-PO	Obs	Dur. PO-U	Dur. U-PO	Ampl. PO-U	Steep. PO-U	Steep. U-PO	Obs	Dur. PO-U	Dur. U-PO	Ampl. PO-U	Steep. PO-U	Steep. U-PO
MENAP hydrocarbon exporters																		
Mean	-	-	-	-	-	-	12	1.17	1.67	3.54	3.13	3.01	10	2.70	2.50	6.45	3.40	3.13
Median		-	-	-	-	-		1.00	1.00	2.34	2.34	1.93		2.00	2.00	5.67	2.40	2.67
SD		-	-	-	-	-		0.39	1.50	2.36	2.00	2.62		1.49	1.65	4.15	3.81	2.1
Coeff. of variation		-	-	-	-	-		0.33	0.90	0.67	0.64	0.87		0.55	0.66	0.64	1.12	0.67
MENAP hydrocarbon importers																		
Mean	14	1.43	1.64	6.95	5.63	4.02	11	2.00	2.54	8.54	4.60	4.46	12	2.17	2.00	2.88	1.71	1.58
Median		1.00	1.50	3.86	3.25	2.26		2.00	1.00	4.01	2.97	2.10		2.00	2.00	3.20	1.35	1.45
SD		0.85	0.84	10.71	10.66	5.23		0.77	2.30	12.92	6.41	4.91		1.47	1.04	1.38	1.36	0.81
Coeff. of variation		0.59	0.51	1.54	1.89	1.30		0.39	0.91	1.51	1.39	1.10		0.68	0.52	0.48	0.80	0.51
All MENAP countries																		
Mean	14	1.43	1.64	6.95	5.63	4.02	23	1.56	2.09	5.93	3.83	3.70	22	2.41	2.23	4.50	2.48	2.28
Median		1.00	1.50	3.86	3.25	2.26		1.00	1.00	3.51	2.37	1.96		2.00	2.00	3.78	1.79	1.73
SD		0.85	0.84	10.71	10.66	5.23		0.73	1.93	9.23	4.61	3.86		1.47	1.34	3.42	2.82	1.69
Coeff. of variation		0.59	0.51	1.54	1.89	1.30		0.47	0.92	1.56	1.20	1.04		0.61	0.60	0.76	1.14	0.74

Notes: Calculations on HP filtered data are reported. Duration, amplitude and steepness of HP filtered data are reported. The steepness is defined as the amplitude divided by the duration, and is measured as percent change. U stands for upturn and PO stands for potential output. Phases not completed at the beginning and/or end of the sample have been excluded from the calculations.

Table 5: Summary Statistics of all the Variables

Variable	Obs	Mean	SD	Min	Max
All MENAP countries					
Non-oil output growth (first year of recovery)	57	9.97	8.02	0.10	38.20
Recession amplitude	57	5.03	6.39	0.54	46.55
Recession duration	57	1.88	1.17	1.00	5.00
Fiscal impulse	57	0.21	6.23	-33.87	17.37
Real export growth	57	2.54	13.69	-26.61	52.55
Non-oil trade openness	57	47.52	28.24	5.14	130.78
Fixed capital formation/Pot. GDP	57	21.03	7.85	1.97	45.85
Fixed capital formation/Pot. GDP at U-1	57	20.85	6.99	2.49	42.37
Fixed capital formation/Pot. GDP over the recession	57	21.11	7.51	2.23	45.85
Nominal broad money growth	57	17.41	17.17	-7.37	87.91
Real broad money growth	45	8.13	14.09	-29.05	70.34
Real domestic credit growth	35	8.75	27.80	-68.84	136.48
Public debt/Pot. GDP	41	73.27	54.05	0.00	205.91
MENAP hydrocarbon importers					
Non-oil output growth (first year of recovery)	36	7.99	5.96	0.10	38.20
Recession amplitude	36	5.09	7.61	0.54	46.55
Recession duration	36	1.86	1.10	1.00	5.00
Fiscal impulse	36	0.56	2.95	-7.40	7.25
Real export growth	36	0.55	10.30	-26.61	18.80
Non-oil trade openness	36	41.60	21.11	5.14	99.21
Fixed capital formation/Pot. GDP	36	20.54	8.01	1.97	45.52
Fixed capital formation/Pot. GDP at U-1	36	21.37	7.49	2.49	42.36
Fixed capital formation/Pot. GDP over the recession	36	20.88	7.51	2.23	45.52
Nominal broad money growth	36	19.18	19.89	-7.37	87.91
Real broad money growth	31	8.63	15.67	-29.05	70.34
Real domestic credit growth	25	3.32	19.01	-68.84	47.05
Public debt/Pot. GDP	20	108.07	51.16	56.79	205.91
MENAP hydrocarbon exporters					
Non-oil output growth (first year of recovery)	21	13.35	9.94	3.62	37.92
Recession amplitude	21	4.93	3.61	0.99	13.26
Recession duration	21	1.90	1.30	1.00	5.00
Fiscal impulse	21	-0.38	9.63	-33.87	17.37
Real export growth	21	5.96	17.87	-25.62	52.55
Non-oil trade openness	21	57.65	35.82	9.69	130.78
Fixed capital formation/Pot. GDP	21	21.87	7.69	10.41	45.85
Fixed capital formation/Pot. GDP at U-1	21	19.96	6.11	9.39	10.41
Fixed capital formation/Pot. GDP over the recession	21	21.51	7.68	28.91	45.85
Nominal broad money growth	21	14.37	10.86	1.46	39.18
Real broad money growth	14	7.01	10.15	-10.56	24.34
Real domestic credit growth	10	22.33	40.86	0.64	136.48
Public debt/Pot. GDP	21	40.13	31.49	0.00	94.04

Notes: Mauritania 2002 observation has been excluded in the domestic credit related calculations since it is an outlier.

Table 6: Regressions of Non-Oil Output Growth in the First Year of Recovery, 1980–2008

	(1)		(2)		(3)	
Recession amplitude	0.671	***	0.365	***	0.661	***
	(9.53)		(3.85)		(17.17)	
Recession duration	-0.577		-0.680		-1.289	***
	(-1.27)		(-1.50)		(-2.88)	
Fiscal impulse	0.650	***	0.637	***	0.798	***
	(4.29)		(3.50)		(3.24)	
Real export growth	0.046		0.084	***	0.107	**
	(1.13)		(3.55)		(2.03)	
Non-oil trade openness	0.081	***	0.032		0.071	**
	(4.84)		(1.37)		(2.17)	
Fisc. Imp. * non-oil trade open.	-0.011	***	-0.008	***	-0.011	***
	(-5.50)		(-3.21)		(-3.05)	
Fixed capital formation/Pot. GDP	-0.017		-0.064		0.045	
	(-0.17)		(-0.63)		(0.40)	
Nominal broad money growth	-0.0004					
	(-0.17)					
Real broad money growth			-0.005			
			(0.32)			
Public debt/Pot. GDP					-0.037	***
					(-3.49)	
Constant	4.124		9.699	***	8.223	**
	(1.54)		(4.41)		(2.19)	
Obs.	57		45		41	
R-squared	0.829		0.520		0.928	

Notes: See Appendix I for definitions of the variables. The numbers in parenthesis report robust t-statistics. Estimations performed using ordinary least squares including fixed effects. ***, **, and * denote significance at 1 percent, 5 percent, and 10 percent, respectively. All explanatory variables are values at U, except the fixed capital formation variable which is at U-1.

Chapter 2: Medium-Term Expenditure Frameworks and Fiscal Performance

Abstract

In the past twenty years more than 130 countries have adopted Medium-Term Expenditure Frameworks (MTEFs) as a tool for improving fiscal performance. The rationale behind these reforms is that MTEFs allow governments to more adequately incorporate future fiscal challenges in the budget process, thereby reducing an undue emphasis on short-term goals. This paper empirically investigates the MTEFs' impact on three key aspects of fiscal performance using a newly-collected MTEF dataset which covers 181 countries over the period 1990-2008. It is found that MTEFs strongly improve fiscal discipline and has a larger effect at more advanced MTEF levels. Higher-phase MTEFs also improve allocative efficiency. Only the most sophisticated MTEFs have a significantly positive effect on technical efficiency, although this result is not always robust. The paper also explores conditions that may affect the functioning of an MTEF, such as the presence of a fiscal responsibility act, political cohesion, democracy and technical assistance missions.[1]

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1. Introduction

Government finances based on an annual cycle of budget planning and implementation suffer from critical problems. Wildavsky (1986, p.317) put it as follows: "One-year [budgeting], it has been argued, leads to short-sightedness, because only the next year's expenditures are reviewed; overspending, because huge disbursements in future years are hidden; conservatism, because incremental changes do not open up large future vistas; and parochialism, because programs tend to be viewed in isolation rather than in comparison with their future costs in relation to expected revenue."

In order to address the shortcomings of annual budgets, the World Bank and the international aid community supported the adoption of Medium-Term Expenditure Framework (MTEF). MTEFs translate macro-fiscal objectives and constraints into broad budget aggregates and detailed expenditure plans. When it is implemented well, spending is limited by resource availability (fiscal discipline), budget allocations reflect spending priorities (allocative efficiency), and the delivery of public goods and services is cost effective (technical efficiency).

This paper is the first to present large-sample empirical evidence on the MTEFs' impact on fiscal performance. Although some qualitative papers have been written about the necessary conditions that need to be in place for MTEFs to be successful, no systematic empirical evidence has been provided on the actual impacts of the MTEF on fiscal performance. In part, this reflects the lack of comprehensive data on MTEF implementation across countries. As a result, the existing literature offers a limited view on which to draw lessons on past experiences.

This study aims to fill this gap in the literature by constructing a panel dataset for 181 countries over the period 1990-2008 of the three MTEF phases: Medium-Term Fiscal Framework (MTFF, which focuses on medium-term fiscal aggregates), Medium-Term

Budgetary Framework (MTBF, which considers the allocation of aggregate spending over sectors) and Medium-Term Performance Framework (MTPF, which in addition considers performance aspects of spending). Second, it investigates the effect of each MTEF phase on the various aspects of fiscal performance: fiscal discipline, allocative efficiency and technical efficiency. Finally, the paper explores whether the MTEF impact is enhanced by the presence of an operational Fiscal Responsibility Act (FRA) or law, political cohesion, democracy, the number of IMF Missions and membership in the OECD.

The data reveal patterns in the timing of MTEF adoption across regions and levels of development. The OECD countries were the first to adopt MTEFs, and by the early 1990s most countries in this group had an MTPF in place. The bulk of MTEF reforms in Sub-Saharan African countries took place in the 1990s. Latin American countries adopted MTEFs in the 1990s and 2000s, and Eastern Europe and the former soviet republics join the trend in the 2000s. Asian countries, however, do not display a clear adoption pattern. MTEF adoption is very likely endogenous to internal fiscal conditions, which makes the adequate identification of MTEF effects challenging. In this paper, in order to identify MTEFs' impacts the differential patterns of MTEF adoption across regions are exploited.

Both the event study analysis and the econometric results suggest that MTEF adoption strongly improves fiscal discipline and that there is a larger effect with each successive MTEF phase. At the same time, although the event study analysis fails to provide a clear picture, the econometrics analysis reveals that MTBFs improve allocative efficiency. Finally, the MTPF seems to be the only MTEF phase that exerts a significant effect on technical efficiency, although the results are not always robust. As for the regulatory and political factors, it is found that being a member of the OECD has a favorable effect, however none of the other variables influence the effectiveness of an MTEF.

The paper is structured as follows. Section 2 discusses the role of the MTEF and its expected effects on the fiscal performance. It also reviews the relevant contributions in the literature. Section 3 presents some stylized facts. In section 4 the data, the event studies, the empirical strategy, and the interpretation of the econometric findings are presented. Section 5 summarizes the results and suggests directions for future research.

2. Background

This section defines an MTEF, its different phases and their likely impact on fiscal performance. An overview of the literature is also provided.

2.1. The Role of the MTEF

MTEFs represent an approach to budgeting that addresses well-known shortcomings of annual budgeting (Wildavsky, 1986). Most public programs require funding and yield benefits over a number of years, but annual budgeting largely ignores future costs and benefits. Multi-year budget planning is the defining characteristic of MTEFs. Annual budgets take as their starting point the previous year's budget and modify it in an incremental manner, making it difficult to re-prioritize policies and spending.[16] MTEFs take a strategic forward-looking approach to establishing spending priorities and resource allocation. They also look across sectors, programs and projects to see how spending can be restructured to best serve national objectives, which contrasts with the narrow self-interest of spending agencies and beneficiaries that dominates resource allocation under annual budgeting (World Bank, 1998).

[16] While incremental budgeting can work well in times of revenue growth, it comes under particular pressure when revenue falls, becomes more volatile or reaches its natural limit, and expenditure prioritization takes on increased importance.

MTEF effectiveness is assessed by identifying its impact on the three aspects of fiscal performance: fiscal discipline, allocative efficiency, and technical efficiency. Thus, if MTEF adoption constrains spending by resource availability (fiscal discipline), makes budget allocations reflect spending priorities (allocative efficiency), and generates cost effectiveness of the delivery of public goods and services (technical efficiency), it should lead to an improvement in all three of these areas.[17]

Moreover, there are many cross synergies among these different aspects of fiscal performance. With an effective MTEF in place, governments should be free to focus on the microeconomic challenges of improving spending efficiency and not be pre-occupied with having to address the adverse macroeconomic consequences of persistent fiscal imbalances.[18] It should also be easier to maintain fiscal discipline if improvements to both allocative and technical efficiency reduce waste and inefficiencies. Moreover, against a background of fiscal discipline, new expenditure needs are more likely to prompt spending reallocations as opposed to requests for additional funding. Finally, both fiscal discipline and expenditure

[17] There is also a link to broader economic development. With improved fiscal outcomes, growth should be higher, inflation lower, and macroeconomic volatility reduced. Moreover, as the quality of spending improves, higher incomes should be accompanied by lower poverty rates, while better infrastructure should contribute to even higher growth and a further poverty reduction.

[18] It can be argued that, in fact, large fiscal imbalances prompt better expenditure prioritization; however, the lessons from fiscal adjustments around the world is that spending cuts are borne disproportionately by high-priority spending, and especially public investment in infrastructure, with adverse consequences for future growth (see, for example, Easterly e al., 2008). Lewis and Verhoeven (2010) report that the growth of public social spending has dipped as the global financial crisis has put fiscal positions under pressure, which risks setting back achievement of human development goals, because these depend on the rapid spending increases achieved in the 1990s and the earlier part of the 2000s.

efficiency create fiscal space for productive spending on economic and social infrastructure, as well as in other high-priority areas, and to respond to fiscal risks.

Following the taxonomy of Castro and Dorotinsky (2008), an MTEF can be broken down into three increasingly advanced phases: MTFF, MTBF and MTPF. MTFFs establish the aggregate fiscal ceilings; MTBFs establish the sector strategies and policies; and MTPFs shift the focus from inputs to outputs, outcomes and performance. Thus the three MTEF phases are "nested:" an MTPF contains an MTBF, which in turn contains and MTFF.

MTEFs can promote fiscal discipline by addressing a number of causes of the deficit bias. For example, by specifying an overall resource constraint, an MTEF reins in the political tendency to over-commit a fixed amount of resources (the common pool problem) because key policymakers have an incentive to internalize costs and benefits of public activities (i.e. centralized or delegation approach), or because policymakers internalize the spending externality by collectively negotiating and committing themselves to detailed multiannual fiscal targets (decentralized approach). These two principles, combined with structures and devices to transparently and efficiently monitor and enforce budget decisions, promote fiscal discipline.

Further, by imparting a medium-term perspective to budgeting and taking into account the future fiscal costs of government policies and programs, an MTEF can fill information gaps that allow politicians to renege on commitments to implement affordable policies (the time consistency problem). A medium-term perspective also encourages governments to conduct discretionary stabilization in a symmetric, counter-cyclical manner, rather than asymmetrically which leads to rising deficits and debt (Kumar and Ter-Minassian, 2007).

In that they set a top-down resource constraint, MTFFs should have a significant impact on fiscal discipline. Of course, fiscal discipline gains are predicated on an MTFF that

works as intended. If rather than being viewed by spending agencies as constraints, ceilings or forward estimates are regarded as minimum entitlements, MTFFs could actually be a source of fiscal indiscipline and deficit bias (Schick, 2010). Since MTBFs and MTPFs incorporate an MTFF, they should have an increasingly strong effect on fiscal discipline compared to an MTFF alone. This is in part because countries that have the capacity to implement an MTBF or an MTPF will have greater success in working with an MTFF. But it is also a consequence of better prioritization and more emphasis on performance, which can bring the payoff to fiscal discipline into sharper focus.

Prioritization guided by longer-term sector strategies should improve resource allocation. Insofar as spending agencies prepare sector strategies, and identify their resource needs and allocate their budgets according to strategic priorities, this bottom–up prioritization should produce a shift to spending with higher economic and social returns. However, the full pay-off to prioritization requires that choices are also made as to how resources should be allocated across sectors, which is done as part of the reconciliation between the top-down and bottom-up approaches involving a lead agency, normally the Ministry of Finance, and spending agencies, and in connection with which less strategic guidance may be available, especially in the absence of national medium-term planning. Moreover, as discussed later, these may be new roles for all the agencies involved, and there may be considerable learning-by-doing before potential resource allocation gains are fully exploited. In addition, difficult decisions have to be made to cut low-priority but often politically sensitive spending.

The outcome of effective prioritization should be a change in the composition of spending. In the short term, compositional volatility may increase following MTEF implementation as spending is reallocated to more productive sectors and programs. Thereafter, insofar as spending decisions are guided by strategic priorities with a longer-term focus, the composition of spending should become less volatile. However, this depends on

how spending previously responded to short-term variations in resource availability. If the practice was that agency and program allocations were subjected to *ad hoc* changes as aggregate spending responds to short-term variations in resources, then longer-term compositional volatility would probably decline. If, on the other hand, spending was cut and restored across the board, or a few particular spending items were adjusted up and down, volatility might increase. On balance, based mainly on cross-country evidence that many fiscal adjustments are opportunistic and low-quality (references), it seems more likely that longer-term compositional volatility should decline, with the pay-off coming mainly from an MTBF and MTPF, although an MTFF may have some effect.

Moreover, a shift away from unproductive spending should be observed. Poor-quality investment, distorting and untargeted subsidies, bloated civil services and the like should not survive scrutiny under the MTEF, while productive spending on economic and social infrastructure, health and education services, and other growth- or development-friendly activities should be favored. So the introduction of an MTBF should certainly be associated with an increase in the share of productive spending in the total, and for an MTPF the impact should be somewhat stronger. An MTFF alone may also have a beneficial effect on resource allocation in that a medium-term resource constraint should lead to some re-examination of spending even with annual, input-focused budgeting.

Technical efficiency is concerned with the link between inputs and outcomes. The better the economic and social outcomes achieved by spending programs from a given amount of budget resources, or the fewer resources used to achieve given outcomes, the more technically efficient is government spending. Improved technical efficiency may follow from an MTFF, but is more likely a consequence of an MTBF and MTPF, with the latter possibly having the largest effect as budgets are linked to results in the form of outcomes or outputs.

2.2. A Review of the Literature

Since the mid-1990s, a large number of countries around the world have introduced MTEFs, in many cases with World Bank support. Reviews of experience with MTEFs, however, have suggested that they may not have lived up to expectations. Following some early work that raised issues about MTEF implementation (e.g., McNab et al., 2000; Oxford Policy Management, 2000), La Houerou and Talierco (2002) in their review of nine countries found that following MTEF introduction there was (i) only small improvement in the fiscal balance in South Africa and Tanzania, (although other studies report improved macroeconomic outcomes, e.g. Bevan and Palomba, 2000); (ii) evidence of reallocation to social spending linked to poverty reduction strategies in South Africa, Tanzania and Uganda, but no consistent pattern in other countries; (iii) no improvement in the budget deviation index;[19] but (iv) increased civil society involvement in the budgeting process when the MTEF is published. The authors conclude that MTEFs, in most countries, have not led to improvements in annual budget preparation; budget behavior has not actually changed; the political leadership has little understanding of the MTEF; and MTEFs can become a means to present an unrealistic budget.

Holmes and Evans (2003) review experience with MTEFs, again in nine countries (eight of which are in Africa). They conclude that MTEFs improved budgeting practices, albeit unevenly, and that in many cases they have both facilitated and were strengthened by the current emphasis on implementing poverty reduction strategies. The authors identify similar shortcomings as La Houerou and Talierco (2002) and highlight other requirements for success that are often not met (e.g., fiscal stability, effective engagement of donors and spending agencies).

[19] The budget deviation index is the sum of the absolute values of the difference between the approved budget and the executed budget expressed as a percentage of the approved budget.

The main conclusion of these two reviews is that MTEFs alone cannot deliver improved public expenditure management in countries in which other key aspects of budget management remain weak. More specifically, MTEF reforms have not taken sufficient account of initial country conditions in basic aspects of budget management and, with the exception of a few cases, have typically not paid sufficient attention to the political and institutional aspects of the reform process.

More recently, the World Bank's Quality Assurance Group (2008) found evidence that MTEFs in Central America were no more successful than those in Africa. Wescott (2008) found mixed results for a sample of countries in different regions, and emphasized the importance of piloting MTEFs in areas where they are likely to deliver the largest payoff. Schiavo-Campo (2008) concluded that, while MTEFs have raised awareness of the need for a medium-term perspective and coordination between government agencies, many MTEFs are characterized by little or no ownership, divert attention from "the basic plumbing" of expenditure management, and strain limited budgeting capacity.

Filc and Scartascini (2010) study MTEFs in Latin America and focus on Argentina, Colombia and Peru. They identified a number of common weaknesses in MTEF implementation, such as poor coordination and the poor quality of both statistics and projections. The authors recommend: (i) countries with weak capacity should introduce MTBFs and not the full MTPF; (ii) the MTFF should cover all government expenditures; (iii) expectations should not exceed feasibility; (iv) major benefits from the MTEF will only accrue if countries are in a sound fiscal position; and (v) to cease the strategic use of projections.

Oyugi (2008) studied the impact of MTEFs in Botswana, Kenya, Namibia, Tanzania and Zambia, and concluded that large budget deviations have compromised fiscal discipline in Botswana and Namibia, annual budgets in Tanzania are unrealistic, budget

reallocation has proved difficult in Kenya, and sector advisory groups hardly meet in Zambia.

The comparative MTEF studies provide a compelling view of the limitations of MTEFs. However, the literature has focused on case studies of a limited number of countries, and therefore still lacks a comprehensive assessment of the MTEFs' impact on fiscal performance. As a consequence, it is not clear whether MTEFs, despite their shortcomings, have been able to improve the budget environment in developing countries. This paper adds to this literature by building a comprehensive global MTEF database and by addressing the endogeneity issues that affect the accurate measurement of MTEF impacts on fiscal discipline, allocative efficiency, and technical efficiency.

3. Stylized Facts

Although some forms of medium-term expenditure projections existed in some OECD countries from the 1960s, the first application of a coherent system of forward budgeting occurred in Australia, where an MTEF was introduced in the 1980s (see Folscher, 2007). The MTEF has since been adopted by a large number of low and middle-income countries as a central element of public financial management (PFM) reform.

In the vast majority of cases the World Bank was involved in the decision to adopt and implement an MTEF, many of which came about as a result of a Public Expenditure Review (PER). The World Bank, however, is not the only sponsor of this approach, which has also been advocated by the UK Department for International Development (DFID), the Asian Development Bank (ADB) and the IMF (1999), though with some reservations.

While MTEFs began to spread across industrial countries and Africa in the early 1990s, it was not until the late 1990s and 2000s that they took off in emerging market economies. At the end of 2008, 132 countries—about two-thirds of all countries—had an

MTEF. As Figure 1 shows, most MTEFs have been implemented since the mid-1990s, with an average of 10 countries a year introducing an MTEF between 1996 and 2008. Initially, MTEFs were dominated by MTFFs, and until recently about two-thirds of the increase in MTEFs has been in the form of new MTFFs. However, there has been a recent uptick in numbers of MTBFs and MTPFs, such that by the end 2008 there were 71 MTFFs, 42 MTBFs and 19 MTPFs. Table 1 shows that the shift to MTBFs and MTPFs has been mainly through transitions from one MTEF phase to another. There are only three countries (Bulgaria, Canada and Norway) that have moved from an MTFF to an MTBF and then to an MTPF during this period.

[Figure 1 about here]

[Table 1 about here]

MTEF coverage varies significantly across country groups. Figure 2 shows that advanced economies have almost achieved complete coverage. Figure 3 shows that MTEF adoption in advanced countries occurred in two waves. In the late 1980s and early 1990s, only a few advanced economies followed Australia's lead in MTEF adoption, and then in the late 1990s MTEFs were introduced mainly in the European Union to support budgetary targets set as pre-condition for monetary union. By the end of 2008, almost half of the MTEFs in advanced economies were MTPFs. As there are relatively few MTBFs in these countries, it suggests that when advanced economies decide to move beyond an MTFF,

introducing a performance focus is a natural development, reflecting their more sophisticated budgeting systems. MTEFs have also achieved broad coverage of the countries in Europe and Central Asia. Figure 4 shows that things moved faster and further in Eastern and Central Europe than in the Former Soviet Union, which may reflect that countries of Eastern and Central Europe have mostly sought quick integration with Western Europe.[20]

[Figure 2 about here]

[Figure 3 about here]

[Figure 4 about here]

Building on an early start in Botswana and Uganda, MTEFs have spread across Sub-Saharan Africa. Three-quarters of countries had one by the end of 2008. The number of MTFFs and MTBFs were relatively equal, and only three countries (Burkina Faso, Mauritius and Namibia) followed South Africa's lead by implementing an MTPF. Figure 5 reveals that MTEFs are now more numerous in Francophone Africa than Anglophone Africa. MTEFs have also been adopted by most countries in South Asia, with Nepal and Sri Lanka having MTBFs.

[20] The countries without an MTEF are Azerbaijan, Belarus, Montenegro, and Turkmenistan.

[Figure 5 about here]

MTEFs are less widespread in other regions, despite a recent spurt of adoptions in East Asia and the Pacific, including MTBFs in Cambodia and Thailand. The picture is similar in Latin America and the Caribbean, where a number of countries have introduced MTFFs following years of managing fiscal policy under IMF programs. Only four countries have moved beyond an MTFF and introduced an MTBF: Argentina, Colombia, Nicaragua and St. Lucia, although Brazil's budgeting system has MTBF characteristics. In the Middle East and North Africa, MTEFs are a very recent innovation. Only Algeria and Jordan have an MTBF while major oil exporting countries (Saudi Arabia, United Arab Emirates) and Egypt have not adopted MTEFs.

The above patterns of MTEF adoption in developing countries have been relatively uniform across income levels, despite pronounced differences between regions. Apart from the widespread adoption of MTEFs in high-income countries, there is little difference across upper middle, lower middle, and lower-income countries. Indeed, if anything, MTEF adoption in developing countries appears to be inversely related to income level (see Figure 6).

[Figure 6 about here]

4. Empirical Analysis

Reflecting the role of MTEFs outlined above, the empirical investigation tests the following three hypotheses:

(i) MTFF improves fiscal discipline.

(ii) MTBF improves allocative efficiency.

MTBF improves fiscal discipline more than MTFF.

(iii) MTPF improves technical efficiency.

MTPF improves allocative efficiency more than MTBF.

MTPF improves fiscal discipline more than MTFF.

Some other factors are thought to condition the MTEF effects on fiscal performance. Many countries have adopted FRAs (or fiscal rules) to safeguard against unsustainable fiscal policy. The presence of a FRA in combination with an MTEF may produce a stronger effect on fiscal discipline or may be redundant and not have any additional effect.

In addition to economic factors, political variables have also been used to explore how the political environment affects fiscal performance. This issue was first highlighted by Roubini and Sachs (1989) who found that, all other things being equal, coalition governments tend to have larger budget deficits than single-party governments. Alesina and Perotti (1995) found similar results. Elgie and McMenamin (2008) initially replicated the political fragmentation model and found results consistent with the earlier studies, using a sample of OECD countries. When they added additional non-OECD democracies, however, the coefficient on the size of political fragmentation was no longer significant, which led the authors to conclude that the results of previous studies were sensitive to sample composition. In the presence of an MTEF, it is expected that greater political cohesion will make the

related reforms easier to pass in the legislature and thus yield a stronger impact on fiscal discipline.

The influence of democracy on fiscal policy outcomes has also been investigated in the literature. Alesina and Tabellini (1990) construct a model in which two policymakers with different objectives alternate power in a democracy. Their model shows that there will be higher deficits in a democracy where citizens disagree about the composition of public expenditures than an economy with an infinitely appointed social planner, and that the deficit bias increases as the degree of polarization between the two parties increases. Thus, it is interesting to explore whether the presence of the MTEF is enhanced in a democratic context.

Technical assistance is expected to have a positive impact on fiscal discipline as significant resources have been directed to strengthening budget institutions during the past two decades (Dabla-Norris et al., 2010).

Therefore, the following conditional effects are investigated:

(vi) MTEF impact is enhanced by the presence of an operational FRA or law.

(v) MTEF impact is enhanced by political cohesion.

(vi) MTEF impact is enhanced by democracy.

(vii) MTEF impact is enhanced by IMF technical assistance.

(viii) MTEF impact is enhanced by the OECD membership.

This section first presents the data and the event studies for the dependent variables. Second, the econometric strategies chosen for the analysis are introduced as well as the estimated specifications. Finally, the results from the estimation of the models are presented and discussed.

4.1. Data

To exploit both cross-sectional and time series variation, a panel dataset of the MTEF phases for 181 countries over the period 1990-2008 is constructed. A brief description of the variables used in the analysis is provided below, while the Appendix contains a comprehensive list of variables and sources.

Fiscal discipline, one of the indicators of fiscal performance, is measured by the central government's overall balance. Although the literature suggests several additional indicators (e.g. primary balance, net debt, interest payments, and total expenditure), data availability limited the choice. Overall balance, beyond offering a greater data coverage, provides a more complete view on the fiscal constraints of the country. On the other hand, it should be noted that, contrary to the primary balance, it does not account from the effect of inflation on interest payments, and that interest payments are a function of accumulated debt and not the present fiscal stance. Primary balance, on a more limited sample of countries, has been used as a robustness check.

The potential proxies for allocative efficiency are budget composition volatility and volatility of core spending (education and health). Since volatility in these sectors jeopardizes long-term objectives, education and healthcare spending should be largely unaffected by short-term fluctuations in GDP. In other words, allocative efficiency implies that spending in core sectors where needs are fairly constant does not behave in a volatile manner. However, given data constraints, the only available indicator is the volatility of the ratio of health spending to total spending, defined as the absolute value of the percentage change in the deviation of the ratio of health spending to total spending, x_{it}, from the trend component

extrapolated using the HP filter[21], $\tau_{x,it}$, minus the same deviation at time $t-1$, normalized by the trend at time $t-1$:

$$HealthSpendingVolatility_{it} = \left|\frac{[(x_{it}-\tau_{x,it})-(x_{it-1}-\tau_{x,it-1})]}{\tau_{x,it-1}} * 100\right| \qquad (1)$$

In order to better understand changes in allocative efficiency, an additional variable, general government expenditure on health as a percentage of total government expenditure, which proxies productive spending is used. If a country adopts an MTEF and this leads to improved allocative efficiency, a likely initial impact is that as health spending is brought in line with policy priorities, the share of health in overall government spending is adjusted. Thereafter, one would expect spending to be relatively stable in line with medium-term policy priorities.

Finally, a Stochastic Frontier Analysis (SFA) is performed to obtain a measure for technical efficiency. This technique was inspired by Farrell (1957), who defined technical efficiency as the ability to produce the maximum possible output from a given set of inputs, and measured it in terms of the relationship between the observed output and the maximum attainable output for the observed inputs. Inefficiencies might arise from waste or because the most cost effective set of programs and interventions are not implemented.

The SFA approach requires the relation between outcomes and inputs to be specified. Thus, the country with the highest health level after controlling for inputs is the most efficient, and the efficiency level of the other countries is measured with respect to the maximum. The frontier is defined as a function of an efficient production to which two disturbances are added: v_{it}, a symmetrical disturbance that includes the random noise and

[21] For the HP filter the smoothing parameter, λ, has been set to 6.25.

u_{it}, a biased strictly non-negative disturbance that is originated by technical inefficiencies.[22] The problem that arises in these methods is that the u_{it} component cannot be observed and must be inferred from the composite error term, $\varepsilon_{it} = v_{it} + u_{it}$. The separation of noise and inefficiency components is made from the conditional expectation of u_{it} given ε_{it} (see Jondrow et al.,1982).

Thus, a production function that shows how health levels, proxied by life expectancy, vary with inputs, health spending per capita in PPP terms, is estimated as follows:

$$LifeExpectancy_{it} = \alpha + \beta HealthSpending\_pc\_PPP_{it} + \gamma Covariates_{it} + \tau_t + v_{it} - u_{it} \quad (2)$$

where the group of covariates is the same as the one used in Greene (2005) when data are available.[23] This group includes population density, years of schooling, a government indicator for voice and accountability, an indicator for government effectiveness, a dummy variable for OECD countries and year effects.[24] All input variables, as well as the output

[22] In this manner, external events that affect the production function are normally distributed, however for v_{it}, the inefficiency term, various distributions have been proposed: normal mean distribution, exponential distribution, normal truncated distribution and Gamma distribution. However, there is no *a priori* reason to prefer any specific type of distribution on the errors.

[23] As a backup strategy, the same production function with child mortality as output of the health sector has been estimated. However, this indicator is a "reverse" output where a lower value is better, requiring a slight modification to the above model. Thus, it was adjusted by using the reciprocal of child mortality, but it should be noted that this modification is a non-linear transformation and cause results to be non-equivalent (in general, any non-linear transformation of input or output data leads to differences in inefficiency estimation results, including the ordering of production units, or countries in this case).

[24] Note that, as in Green (2005), some of the data series were incomplete and had to be linearly interpolated.

variable, enter the production function in log form. The technical efficiency scores are obtained as a transformation of the non-negative disturbance:

$$TechnicalEfficiencyScores_{it} = e^{-v_{it}} \quad (3)$$

The MTEF variables consist of three mutually exclusive dummies[25]—MTFF, MTBF, and MTPF—which were coded as one if a country met the following criteria:

- MTFF: the government has rolling aggregate, expenditure, revenue, and other fiscal forecasts. Features include the availability of a macro-fiscal strategy, macroeconomic and fiscal forecasts, and debt sustainability analysis.
- MTBF: the budget, spending agency or other reports explain aggregate and sectoral expenditure objectives and strategies, budget circulars detail medium-term expenditure ceilings and revenue forecasts, and budget documents contain some detail for medium-term estimates. Note that countries that introduced piloted MTBFs were considered as MTFFs as the health sector might be one of the uncovered ones.
- MTPF: the budget, spending agency or other reports explain program objectives and strategies, listing specific agency and/or program output or outcome targets, as well as results.

For the purpose of this paper, no value judgments were made to distinguish between a well-functioning MTEF and an MTEF which only exists in regulations or law. Such a distinction would introduce a significant amount of subjectivity into the analysis.

[25] The value one has been given in the years in which the country adopted its highest MTEF phase, zero otherwise. Thus, if a country had an MTPF, the other dummies were coded as zero to isolate the impact on the dependent variables and to compare the coefficients for the different MTEF phases in the same regression.

The construction of the MTEF dummies relied upon an extensive data collection effort as no single type of document sufficiently describes the existing institutional arrangements for all countries or even individual countries. Thus, the data were compiled from a large number of sources, including IMF Article IV country reports, IMF Fiscal Transparency Reports on the Observance of Standards and Codes (ROSCs), World Bank PERs, and World Bank Country Financial Accountability Assessments (CFAAs), OECD documents, donor case studies, and country websites (see Appendix for a more detailed description of the data sources). Additionally, World Bank and IMF public sector specialists supplemented the above information with technical details.

In order to test whether the MTEF impact is enhanced by the presence of a FRA, a dummy variable is constructed and takes the value one when an expenditure rule, a revenue rule, a debt rule, or a budget balance rule (or a combination of them) is operational, zero otherwise. Along the same lines, political cohesion is measured through a dummy variable that takes the value one if the fraction of seats held by the government (calculated by dividing the number of government seats by total seats) is higher than 50 percent, zero otherwise.

Many different measures have been used to measure democracy, such as Freedom House, Polity IV, etc. Cheibub et al. (2010), address the strengths and weaknesses of the main democracy indicators, concluding that they are not interchangeable. However, they also argue that a measure of democracy based on a minimalist conception is compatible with most of the theoretical issues that animate empirical research. Thus, in their extension of the dataset firstly published in Alvarez et al. (1996), they include the variable Democracy-Dictatorship (DD) that is adopted in this analysis.

Finally, the number of IMF technical assistance missions has been introduced to test for an enhanced MTEF impact.

Basic descriptive statistics for the data used in the analysis are reported in Table 2.

4.2. Event Studies

The event studies are conducted by normalizing each country's MTEF implementation date to year t, distinguishing between MTFFs, MTBFs and MTPFs. The measures of fiscal discipline, allocative efficiency and technical efficiency, are averaged across countries and plotted for years $t-3$, $t-2$, $t-1$, t, $t+1$, $t+2$ and $t+3$, along with 95 percent confidence intervals. Given an interest in whether MTEFs spur better fiscal performance, it is instructive to compare years $t-3$, $t-2$, $t-1$ with years $t+1$, $t+2$ and $t+3$, and so averages for these periods are indicated.[26] Longer-term pre- and post-MTEF averages are also shown, to provide an indication of the more durable influence of MTEFs.[27]

The event study analysis suggests that fiscal discipline is stronger after MTEF implementation. Panel a of Figure 7 shows that the fiscal deficit is almost 3 percentage points of GDP lower on average in the 3 years following MTEF implementation than in the 3 years preceding it, while the longer-term improvement is around 3.5 percentage points. It would seem, however, that the fiscal improvement is short-lived, with the fiscal balance weakening 3 years after MTEF implementation, but a comparison of longer-term pre- and post-MTEF averages reveals that this down turn and any subsequent deterioration is temporary. Further analysis indicates that the source of the fiscal improvement is both lower spending and higher

[26] A case can be made for including year t as the first year of the post-MTEF period since the MTEF was in effect that year. However, in some cases it is unclear whether an MTEF became operational in the year of implementation, especially in cases where the calendar and fiscal years do not coincide, hence the decision to treat the implementation year as transitional.

[27] Note that not all countries that have implemented MTEFs can be included in the event studies because some MTEFs were in place or introduced very early or late in the 1990-2008 period. Also, since MTPFs are a more recent innovation, there are few countries with these. The event study encompasses 40 MTFFs, 20 MTBFs and 12 MTPFs.

revenue, with a significantly larger contribution from the latter. The pattern is similar for MTFFs (see Panel b of Figure 7).

The fiscal balance actually begins to improve in the year of MTEF implementation. If the MTEF became fully operational in that year this could reflect the immediate impact of the MTEF. However, it was noted above that there are reasons to treat this as a transitional year, and not part of the post-MTEF period. If included as the first of a three year post-MTEF window (comprising years t, $t+1$, and $t+2$), this would show the MTEF as having an even stronger impact since the fiscal balance deteriorates in year $t+3$. Moreover, the earlier improvement in the fiscal balance could also be due to the signaling effect that the MTEF adoption announcement exerts and to the fact that an MTEF is typically adopted with or after other PFM reforms that might be positively affecting the fiscal balance.

MTBFs and MTPFs have a larger impact on fiscal discipline than MTFFs. As Panel c and d of Figure 7 reveal, MTPFs are associated with a larger fiscal improvement than MTBFs. When the components of the fiscal balance are analyzed separately, it is clear that while the improvement under an MTBF is revenue driven, the improvement under an MTPF is expenditure driven. MTPFs are also implemented against the background of much stronger fiscal positions, which could suggest that strong fiscal discipline provides the opportunity to focus on improving efficiency as a means of strengthening fiscal positions. The interpretation of this result is limited, however, by the small number of MTPFs in the sample.

[Figure 7 about here]

Figure 8 confirms the expected long-term reduction in the volatility of allocations to the health sector. No increase in the short-term volatility, however, is observable as one might expect from a shift in budgetary allocations after MTEF adoption. The absence of short-term volatility might be due to the normalization of the volatility measure for the trend at time $t-1$. If the normalization is avoided, the panel for the MTBF (not shown) suggests an increased and somewhat erratic short-term volatility in health spending with an MTBF, which is consistent with a short-term shift in resources to the health sector and a modestly higher health share.

Figure 9 suggests that MTEFs do not have a significant short-term or long-term impact on the health expenditure share, which may indicate that health spending was a sufficiently high priority before MTEF implementation.

[Figure 8 about here]

[Figure 9 about here]

The impact of MTEFs on technical efficiency is difficult to discern from the event study. Figure 10 suggests that an MTEF has no relevant impact on technical efficiency both in the short- and longer-term. While an MTPF appears to have a positive effect on technical efficiency in the short term, the lack of any impact over the longer term is difficult to understand. Again, the small number of MTPFs suggests that the results should be interpreted

with caution. Also, the results are likely affected by the small within-variation of the output variable (life expectancy) and the relatively short time span.

[Figure 10 about here]

4.3. Empirical Strategy

Three well-known methodological challenges must be overcome to correctly identify the impact of a PFM reform, such as an MTEF, on fiscal performance: reverse causality, omitted variable bias, and errors-in-variables.

First, reverse causality arises because fiscal stress (e.g., a financial crisis) may have prompted a country to restrain spending, adopt an MTEF, or strengthen an existing one. The problem has been extensively discussed in the literature (see Alesina and Perotti, 1999; Stein, Talvi and Grisanti, 1999: Knight and Levinson, 2000; Perrotti and Kontopoulos, 2002; and Fabrizio and Mody, 2006), but none of the authors were able to find an instrument which influences the probability of a budgetary reform (or a change in fiscal institutions in general) and is not itself affected by fiscal performance.

If MTEFs have positive effects on fiscal outcomes, and poor fiscal outcomes improve the chances of adopting an MTEF, then the simultaneous causality bias would be expected to be negative. If this were the case, the estimates are still useful as a lower bound for the actual effect. However, if countries adopt MTEFs in good fiscal times, the reverse causality bias is positive. In this case, the estimates would be less informative. To circumvent this issue, the

underlying assumption in the earlier papers has been that budget performance cannot quickly feed back into budgetary reforms.

Second, the omitted variable bias arises due to the failure to account for a factor that affects both the adoption of an MTEF and fiscal performance. For instance, strong economic growth may reduce the pressure on a government to reform fiscal institutions, and, at the same time, improve the government's fiscal outcomes, thus leading to a negative omitted variable bias. In general, the risk of attributing the effect of the omitted variables to the regressors will generate an overstatement of the fiscal institutions effect. As specified by Fabrizio and Mody (2006), a partial solution to this problem is to disregard the variation across countries and analyze only the within-country variation. This approach, in effect, eliminates the country specific fixed effects that may influence budget deficits but may not be observed. Thus, by focusing on variations within a country over time, the problem of omitted variables is alleviated but not eliminated. Most studies have not been able to adopt this method because either budget institutions do not move much over time or because these movements are difficult to measure. Where it has been implemented, Knight and Levinson (2000) suggest that the results are typically different from those obtained in cross-country analysis, indicating that the problem of omitted variables is relevant.

Finally, if some of the variables in the analysis are not measured accurately, there is the potential for errors-in-variables bias, which usually dampens the effect of interest. Although in the empirical model, the primary explanatory variable, MTEF status, can be observed with a high degree of precision, there is still scope for measurement error in the MTEF dummies and the other explanatory variables.

To address these endogeneity issues, an instrument for MTEF adoption is constructed, defined as the geographic diffusion of a given MTEF phase. As mentioned, MTEFs have, to a certain extent, spread geographically among close countries. Countries in the same region

adopt MTEFs at short time intervals from each other. At the same time, there is little reason to expect that a neighbor's fiscal institutions directly affect a country's fiscal performance, which likely satisfies instrument exogeneity. Regional MTEF diffusion is defined as follows:

$$Diffusion_{i,t}^{MTEF} = reformers_{r,t} - i/r - i \quad (4)$$

where i is the observed country, r is the total number of countries in the geographical region[28], and $reformers$ is the number of countries in the region that introduced the MTEF.

Unfortunately, only two of the three instruments pass the relevance test – MTPF diffusion is not strong enough to serve as a valid instrument jointly with the other two. To overcome the strength issue, the three static instruments are augmented with dynamic instruments, as suggested by Arellano and Bond (1991).[29] This strategy also allows us to account for possible persistence in fiscal outcomes, by using a lagged dependent variable.[30]

[28] The United Nations sub-regions classification has been adopted for the diffusion instrument calculation.

[29] The Arellano-Bond (1991) and the Arellano-Bover (1995)/Blundell-Bond (1998) dynamic panel estimators have become increasingly popular. As Roodman (2006) notes, both are general estimators designed for situations with "small T, large N" panels, a linear functional relationship, a single left-hand-side variable that is dynamic, independent variables that are not strictly exogenous (correlated with past and possibly current realizations of the error), fixed individual effects, and heteroskedasticity and autocorrelation within individuals but not across them.

[30] Lagging the dependent variable might alleviate the reverse causality problem as well, if fiscal reforms respond to fiscal crises with a lag.

Arellano-Bond estimation, also known as "Difference GMM", transforms all regressors by differencing and uses the Generalized Method of Moments (Hansen 1982).[31] However, the lagged levels of the regressors might be poor instruments for the first-differenced regressors. If this is the case, the Arellano-Bover/Blundell-Bond estimator, also known as "System GMM", should be used. This estimator uses the levels equation to obtain a system of two equations: one differenced and one in levels. By adding the second equation, additional instruments can be obtained. Thus, the variables in levels in the second equation are instrumented with their own first differences. The underlying additional assumption is that first differences of instrumented variables are uncorrelated with the fixed effects. This technique allows the introduction of more instruments, and can dramatically improve efficiency.

Moreover, both country and time variation in the data are exploited by controlling for (i) long-term country characteristics, such as culture and norms (using country fixed effects); and (ii) global factors that impact all countries, such as resource prices (using year fixed effects). A possible concern about the exogeneity of neighbors' MTEF adoption status is that it is driven by regional shocks that affect countries located in the same geographical region. To control for this confound, region-year interactions (or region-specific time trend) have been included.

Errors are robust to heteroskedasticity and, following Bertrand et al. (2004), are clustered at the country level to correct for possible serial correlation within countries.

[31] Sometimes, the forward orthogonal deviations transform, proposed by Arellano and Bover (1995), is performed instead of differencing.

4.4. Baseline Specifications and Conditional Effects

An empirical model which relates fiscal performance to the introduction of the MTEF frameworks and a set of covariates is estimated for each performance indicator:

$$FiscalPerformance_{it} = \alpha + \beta_1 MTFF_{it} + \beta_2 MTBF_{it} + \beta_3 MTPF_{it} + \gamma Covariates_{it} + v_i + \tau_t + u_{it} \quad (5)$$

where the dependent variable $FiscalPerformance_{it}$ is the ratio of overall fiscal balance of the central government to GDP for fiscal discipline, the volatility of health spending to total spending and the health spending share for allocative efficiency, and the technical efficiency scores derived from the stochastic frontier estimation for technical efficiency; $MTFF_{it}$, $MTBF_{it}$ and $MTPF_{it}$ are mutually exclusive dummy variables for the presence of the frameworks; $Covariates_{it}$ include a set of controls commonly used in the literature such as GDP growth, trade openness, population, inflation, aid and dummies for oil exporters, conflicts, HIPC initiative, IMF program and credit market access; $v_i$is a set of unchanging country specific effects (proxied by country dummies); τ_t are effects common to all countries in period t (time dummies); and u_{it} is the error term.

To test the conditional effects hypotheses, a second set of regressions is estimated with the addition of interaction terms to study the conditional effects on MTFF is estimated:

$$FiscalPerformance_{it} = \alpha + \theta_0 c_{it} + \beta_1 MTFF_{it} + \theta_1 (MTFF_{it} * c_{it}) + \beta_2 MTBF_{it} + \beta_3 MTPF_{it} + \gamma Covariates_{it} + v_i + \tau_t + u_{it} \quad (6)$$

where c_{it} is one of the conditioning variables identified above.

To check the sensitivity of the results to alternative specifications, the model with alternative sets of covariates and instruments is estimated. Furthermore, the robustness of the results is checked by using pooled Ordinary Least Squares (OLS), and by introducing fixed effects, year effects and regional trends. In these models, identification is based on uninstrumented difference-in-differences comparisons.

Another relevant concern is the robustness of the results to possible outliers. In particular, because of the large changes in fiscal balance in some countries or changes in fiscal institutions not well documented, the question arises whether the results are driven by these countries. The approach proposed by Milesi-Ferretti et al. (2002) is followed, excluding one region at a time to test for the possibility of influential observations.

4.5. Empirical Results

The results for fiscal discipline are presented in Table 3. From column (1) to column (8) the same specification is estimated using different techniques. Endogeneity is best handled when the Arellano-Bond System GMM estimator is adopted (columns (5) to (8)) and the results overall confirm a strong and positive contribution of all the phases of the MTEF to fiscal discipline. As expected, the higher the level of MTEF sophistication (from an MTFF to an MTBF and finally to an MTPF), the bigger the magnitude of the impact. For instance, in column (8), the preferred specification, the adoption of an MTFF increases the overall fiscal balance by 0.85 percentage points, the MTBF by 0.99 percentage points and the MTPF by 2.82 percentage points.

Among the controls, the coefficient for oil exporters has an important impact on fiscal discipline. It has a positive and significant sign with a fairly high magnitude, implying that oil exporting countries enjoy extra revenues that improve the overall fiscal balance. At the same time, armed conflicts worsen the overall fiscal balance. Likewise, the aid variable presents a

small, significant and negative coefficient, which could be the result of lower disbursements with respect to what was committed by donors. In Column (9), credit market access is added to the equation, but the estimated coefficient on this variable was not significant. It is worthwhile noting that both the magnitude and the statistical significance of the main three coefficients remain robust despite the large number of missing observations on this variable.

[Table 3 about here]

Estimates remain statistically strong and qualitatively similar across all specifications in Table 3. Although estimated coefficients for MTEF dummies are higher in magnitude, they are positive, significant and almost always scaled from MTFF to MTPF. Significance is only lost for MTFF and MTBF when the uninstrumented difference-in-differences approach is adopted.

In Table 4, the regulatory and political factors that may potentially affect the MTEFs' impact are explored. In column (1), it is measured how MTFF's impact depends on the presence of a FRA. The estimates suggest that a FRA improves the effect of MTFF on fiscal balance by 0.6 percentage points, but this improvement is not statistically different from zero. Column (2) suggests that an MTFF's impact does not depend on whether the ruling government has a majority, while column (3) finds no support for the notion that MTEFs' effects are different between democracies and autocracies. Column (4) finds no evidence that IMF missions influence the effectiveness of an MTFF. Finally, column (5) suggests that MTPFs are significantly more effective in OECD countries.

[Table 4 about here]

Tables 5 and 6 show the empirical findings of the MTEF impact on allocative efficiency. The dependent variable in Table 5 is the volatility of health spending, as previously defined. The volatility measure alone, however, may not provide the full picture of the effect of the MTEF on allocative efficiency. Therefore, Table 6 presents the results for productive spending, proxied by general government expenditure on health as a percentage of total government expenditure.

Column (8) of Table 5 provides the results for the specification that best handles endogeneity issues. The strongest effects are expected on the MTBF and MTPF variables, and this is partially confirmed in the empirical findings. More specifically, MTBF reduces the volatility of health allocations by 2.95 percentage points and a non-negligible negative and significant effect comes from the implementation of the MTFF, which reduces the health spending volatility by 2.66 percentage points. This effect is likely to be due to the inclusion of the piloted MTBFs into the MTFF category.[32] Finally, countries that introduced an MTPF do not experience a significant reduction in the volatility of health expenditures. There are two possible explanations. First, countries with MTPFs are typically the advanced economies (see Figure 6) that already have low volatility levels. Second, as highlighted in Section 3, none of the MTPF reformers transitioned from having no MTFF or an MTFF, to an MTPF. Thus, although half of the MTPFs were adopted concurrently with the MTBF, the other half

[32] Typically, the health sector is one of the piloted ones.

of countries already had an MTBF that most likely already impacted the volatility of health spending prior to MTPF adoption.

The only covariate that presents a significant coefficient is the aid variable. More, specifically, aid flows seem to increase the volatility of health spending and this might reflect the unpredictable nature of aid flows. In column 9, the Credit Market Access variable is once again added to the specification, and although the coefficient has the expected negative sign, it is not significant.[33] In the same specification, being an oil exporter significantly increases the volatility in health spending as predicted. This result is likely to be due to the windfall revenues that the oil dependence generates.

Overall, the results are quite robust to the employment of other techniques, although significance is lost when the difference-in-difference approach is used.

[Table 5 about here]

Table 6 completes the picture of allocative efficiency by showing the results for productive spending. The dependent variable is general government expenditure on health as a percentage of total government expenditure. As expected, Column (8) shows a positive and significant effect for all the MTEF phases, with the magnitude scaled from MTFF to MTPF. More specifically, MTEF adoption increases spending on health as a percentage of the total

[33] Note that both aid flows and credit market access imply incoming funds, however the expected signs on the two variables are opposite. In the former case, the money inflow is poorly predictable, therefore generating variability in the allocations across sectors; in the latter case, the country resorts to credit market only when it needs to, for example when it finds hard to maintain the spending level constant in some sectors.

spending by 0.40 percentage points, the MTBF by 0.48 percentage points and the MTPF by 1.04 percentage points. Interestingly, only MTBF is significant once the Credit Market Access variable is introduced, which also has a positive and strongly significant effect.

As expected, GDP growth increases expenditure on health as a percentage of total spending. At the same time, being an oil exporter negatively affects the relative spending on health, probably because resources are dedicated to investments in oil related activities.

The use of other techniques generates positive signs on the MTEF dummies, however, the results are not always significant. Overall, Tables 5 and 6 provide evidence that MTEF adoption exerts a positive effect on allocative efficiency.

[Table 6 about here]

Finally, Table 7 presents estimates of the MTEF's impact on technical efficiency.The specification that best handles endogeneity is presented in column 8, which shows a positive and significant effect from MTPF adoption. As expected, it is only the last phase of the MTEF that has a significant effect on the technical efficiency.

The results are quite robust for all the specifications employing the GMM estimator. The findings from the application of other estimation techniques show mixed results.

[Table 7 about here]

Overall the results provide evidence that MTEF adoption improves fiscal discipline and that more advanced stages yield a greater impact. At the same time, productive spending is enhanced in MTEF countries and MTBF (and MTFF to a lesser extent) adoption decreases the volatility of health spending as a ratio of total spending, thus improving allocative efficiency. Finally, the MTPF seems to be the only MTEF phase that exerts a significant effect on technical efficiency in the health sector, although results are not always robust.

5. Conclusions

In the last twenty years, MTEFs have been adopted by more than 130 countries, and have achieved almost significant coverage across the globe. Although there has been much debate in the literature as to whether MTEFs are a worthwhile strategy, this paper is the first to empirically investigate the impact of MTEFs on fiscal performance in a broad sample of countries. In order to disentangle the effect of each MTEF phase (MTFF, MTBF and MTPF), a panel dataset spanning 181 countries over the period 1990-2008 is constructed.

The event study analysis suggests that fiscal discipline is stronger after MTEF implementation and also in the longer-term. Moreover, it shows that MTBFs and MTPFs have a larger impact on fiscal discipline than MTFFs. As expected, the volatility of allocations to the health sector decreases in the long-term, but no clear short- or longer-term effect is observable on the health expenditure share. Lastly, the impact of MTEFs on technical efficiency is difficult to distinguish from the event study and only the MTPF seems to have a short-term positive impact.

The econometric findings corroborate the event study results. MTEF adoption is associated with a strong improvement in fiscal discipline and there is a greater effect with each successive MTEF phase. More clearly than the event study, relative spending on health

is enhanced in the MTEF adopting countries and MTBF adoption decreases the volatility of health spending as a ratio of total spending, thus improving allocative efficiency. Finally, the MTPF seems to be the only MTEF phase that exerts a significant effect on technical efficiency of the health sector, although results are not always robust. No significant effect on MTEF effectiveness is found, however, from the number of IMF missions, political factors such as majority vs. minority governments or democratic vs. autocratic governments, or FRA adoption, while OECD membership generates a positive and significant effect.

This analysis may be subject to two caveats. First, an MTEF might be in place only in law (*de jure*) and not in practice (*de facto*). The potential bias in this case, however, is negative and the estimates could still be regarded as a lower bound. Second, the analysis of the impact on allocative efficiency and technical efficiency is limited to the health sector and does not represent the entire budget composition due to limited data availability.

Overall, the evidence is supportive of MTEF implementation and, in particular, of MTPFs. Thus, the results may be of particular interest to multilateral and bilateral providers of technical assistance to PFM reforms, and to country authorities seeking to introduce or strengthen an MTEF.

Appendix

Table A: Variables and sources

Variable	Source	Definition
Fiscal Discipline	WEO	Ratio of the overall central government fiscal balance to GDP.
Health Spending Volatility	WHO	Absolute value of the percentage change in the deviation of the ratio of health spending to total spending from the trend componentextrapolated using the HP filter, minus the same deviation at time t-1, normalized by the trend at time t-1.
Productive Spending	WHO	General government expenditure on health as a percentage of total government expenditure.
Technical Efficiency	WDI	Estimations of the efficiency scores from a stochastic frontier model that shows life expectancy as output and health spending per capita in PPP terms as input (along with population density, years of schooling, a government indicator for voice and accountability, and one for government effectiveness, a dummy variable for OECD countries and year effects).
MTFF	World Bank / IMF documents; Case Studies	Dummy variable that takes the value one if the MTFF is the highest framework adopted, zero otherwise.
MTBF	World Bank / IMF documents; Case Studies	Dummy variable that takes the value one if the MTBF is the highest framework adopted, zero otherwise.
MTPF	World Bank / IMF documents; Case Studies	Dummy variable that takes the value one if the MTPF is the highest framework adopted, zero otherwise.
MTFF Diffusion	World Bank / IMF documents; Case Studies; UN data	Ratio of countries in the same UN region adopting an MTFF to the number of countries in the UN region, excluding the country itself.
MTBF Diffusion	World Bank / IMF documents; Case Studies; UN data	Ratio of countries in the same UN region adopting an MTBF to the number of countries in the UN region, excluding the country itself.
MTPF Diffusion	World Bank / IMF documents; Case Studies; UN data	Ratio of countries in the same UN region adopting an MTPF to the number of countries in the UN region, excluding the country itself.
Health Spending Per Capita (PPP)	WHO	Education Expenditure per capita in PPP terms.
GDP Per Capita (PPP)	WEO	Current GDP per capita in PPP terms.
Population Density	WDI	People per squared kilometer.
Years of Schooling	WDI	Number of years of primary and secondary education completed.
Government Voice and Accountability	WGI	Index capturing perceptions of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media.

Table A (*Continued*)

Variable	Source	Definition
Government Effectiveness	WGI	Index capturing perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies.
OECD	OECD	Dummy variable that takes the value one if the country belongs to the OECD club, zero otherwise.
FRA	FAD Fiscal Rules Database	Dummy variable that takes the value one if a debt rule or a balanced budget rule or a revenue rule or an expenditure rule is adopted, zero otherwise.
Political Cohesion	DPI	Dummy variable that takes the value one if the fraction of seats held by the government (calculated by dividing the number of government seats by total seats) is higher than 50 percent, zero otherwise.
Democracy	Cheibub et al (2010)	Democracy-Dictatorship (DD) dummy variable that takes the value one if a regime meets the following requirements: (1) the chief executive must be chosen by popular election or by a body that was itself popularly elected, (2) the legislature must be popularly elected, (3) there must be more than one party competing in the elections, (4) an alternation in power under electoral rules identical to the ones that brought the incumbent to office must have taken place, zero otherwise.
IMF Missions	IMF	Number of IMF FAD Technical Assistance missions per year.
GDP Growth	WDI	Real GDP growth rate.
Trade Openness	WDI	Trade openness measured as the ratio of the sum of imports plus exports to GDP.
Inflation	WEO	Inflation rate.
HIPC Initiative	World Bank	Dummy variable that takes the value one if the country is in the period between the decision point and the completion point, zero otherwise.
Aid	OECD	Overseas Development Assistance net disbursements as a percentage of GDP.
Oil-Exporter	WEO	Dummy variable that takes the value one if the ratio of oil exports to GDP is higher or equal to 30 percent.
Conflict	CSCW	Dummy variable that takes the value one if there are at least 1,000 battle-related deaths, zero otherwise.
IMF Program	IMF	Dummy variable that takes the value one if the country had an IMF Program, zero otherwise.
Population	WDI	Population in millions.

Table 1: Sources of MTEF Growth, 1990-2008

	1990	New MTEFs	Transitions	Reversals	2008
MTFF	9	104	-41	-1	71
MTBF	1	21	23	-3	42
MTPF	1	0	18	0	19
MTEF	11	125	0	-4	132

Notes: The MTFF reversal is Argentina, the MTBF reversals are Argentina, Estonia and the US. 9 out of the 18 transitions to MTPF are from MTFF and 9 from MTBF.

Table 2: Descriptive Statistics

Variable	Obs.	Mean	Standard Deviation		Min	Max
			Across	Within		
Fiscal Discipline	2991	-2.24	9.40	9.59	-151.33	384.15
Health Spending Volatility	2293	8.88	6.92	10.45	0.00	188.74
Productive Spending	2471	10.64	4.18	1.93	0.00	41.33
Technical Efficiency	1434	90.82	7.58	1.20	61.51	99.21
MTFF	3378	0.17	0.20	0.32	0	1
MTBF	3378	0.07	0.15	0.22	0	1
MTPF	3378	0.04	0.15	0.13	0	1
MTFF Diffusion	3359	0.17	0.12	0.18	0	1
MTBF Diffusion	3359	0.07	0.09	0.12	0	1
MTPF Diffusion	3359	0.04	0.12	0.08	0	1
Health Spending Per Capita (PPP)	2465	667.68	939.93	284.37	0	7536.27
GDP Per Capita (PPP)	3140	8735.82	10464.41	3428.78	122.88	79485.46
Population Density	3304	188.89	638.90	60.86	1.43	6943.19
Years of Schooling	1435	10.50	2.29	0.56	2.10	16.67
Government Voice and Accountability	1798	47.78	27.92	5.26	0	100
Government Effectiveness	1756	48.18	27.96	6.59	0	100
OECD	3439	0.16	0.36	0.08	0	1
FRA	3439	0.25	0.32	0.29	0	1
Political Cohesion	2798	0.82	0.25	0.29	0	1
Democracy	3325	0.56	0.46	0.18	0	1
IMF Missions	3439	0.51	0.75	1.64	0	32
GDP Growth	3250	3.74	2.63	6.18	-51.03	106.28
Trade Openness	3069	85.28	49.14	16.89	0.31	456.65
Inflation	3202	47.39	164.88	477.52	-26.32	23773.10
HIPC Initiative	3439	0.04	0.10	0.17	0	1
Aid	3233	3.67	6.88	3.81	-2.96	96.42
Oil-Exporter	3233	0.07	0.24	0.11	0	1
Conflict	3439	0.05	0.14	0.17	0	1
IMF Program	3378	0.33	0.35	0.32	0	1
Population	3426	32.86	122.00	8.64	0.01	1324.66

Notes: The sample consists of 181 countries during 1990-2008. Data sources and units of measurement are presented in the Appendix.

Table 3: MTEF Effects on Fiscal Discipline

Dependent Variable = Central Government Balance as percentage of GDP

	(1) Pooled OLS	(2) FE	(3) DID	(4) DID with regional trends	(5) AB System GMM	(6) AB System GMM with IV	(7) AB System GMM with year effects	(8) AB System GMM with IV and with year effects	(9) AB System GMM with IV and with year effects
MTFF	1.94***	1.46***	0.09	0.46	1.16***	1.61***	0.58	0.85**	0.86*
	(0.43)	(0.44)	(0.52)	(0.48)	(0.37)	(0.42)	(0.44)	(0.42)	(0.49)
MTBF	1.65***	2.24***	0.22	0.64	1.56***	1.95***	0.82	0.99*	1.17*
	(0.54)	(0.55)	(0.70)	(0.66)	(0.50)	(0.54)	(0.56)	(0.52)	(0.60)
MTPF	3.95***	5.67***	2.47**	2.97***	2.57***	3.83***	1.82**	2.82***	3.00**
	(0.63)	(0.86)	(1.06)	(0.84)	(0.92)	(0.99)	(0.93)	(0.96)	(1.25)
Lag GDP Growth	0.08***	0.11***	0.08***	0.07***	-0.03	-0.03	-0.03	-0.03	-0.01
	(0.03)	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Trade Openness	0.01	0.01	-0.00	0.00	0.00	0.00	0.00	0.00	-0.00
	(0.00)	(0.01)	(0.01)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Oil Exporter	6.08***	4.37***	3.52***	3.20***	4.08***	4.17***	3.84***	3.89***	5.09***
	(1.68)	(0.96)	(0.97)	(0.92)	(1.03)	(1.04)	(1.04)	(1.04)	(1.18)
Conflict	-3.04**	-2.56**	-2.05**	-2.00*	-1.61**	-1.58**	-1.60**	-1.56**	-1.64*
	(1.23)	(1.11)	(1.03)	(1.10)	(0.66)	(0.65)	(0.65)	(0.64)	(0.88)
Lag IMF Program	0.08	0.25	0.49	0.32	-0.25	-0.23	-0.22	-0.20	-0.41
	(0.44)	(0.37)	(0.36)	(0.38)	(0.29)	(0.30)	(0.30)	(0.30)	(0.41)
Population	0.00	0.02	-0.07*	-0.06	-0.00	-0.00	-0.00	-0.00	-0.00
	(0.01)	(0.04)	(0.04)	(0.06)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Population Sq.	-0.00	-0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Inflation	-0.00**	-0.00**	-0.00**	-0.00	0.00	0.00	0.00	0.00	0.01***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
HIPC	-0.13	-0.46	-0.62	-2.03***	0.15	0.08	-0.10	-0.13	-0.05
	(0.77)	(0.76)	(0.80)	(0.72)	(0.76)	(0.75)	(0.78)	(0.77)	(0.80)
Aid	-0.11**	-0.06	-0.03	-0.02	-0.05*	-0.05	-0.06*	-0.05*	-0.04
	(0.05)	(0.05)	(0.04)	(0.04)	(0.03)	(0.03)	(0.03)	(0.03)	(0.04)
Lag Fiscal Discipline					0.37***	0.37***	0.33***	0.35***	0.31***
					(0.08)	(0.08)	(0.08)	(0.08)	(0.09)
Lag Credit Market Access									0.70
									(0.53)
Fixed Effects	N	Y	Y	Y	-	-	-	-	-
Year Effects	N	N	Y	N	N	N	Y	Y	Y
Countries	162	162	162	162	162	162	162	162	162
Instruments	-	-	-	-	27	30	44	47	43
AR(2) test [*p*-value]	-	-	-	-	0.171	0.168	0.134	0.126	0.255
Hansen *J* [p-value]	-	-	-	-	0.605	0.58	0.468	0.315	0.398
Observations	2,613	2,613	2,613	2,613	2,605	2,605	2,605	2,605	1,914
R-sq.	0.16	0.49	0.53	0.55	-	-	-	-	-

Notes: Robust standard errors are in parentheses, clustered by country. GMM specifications use lags 1-3 of the endogenous variables with collapsed instrument matrix. Three additional instruments based on MTEF diffusion in the neighboring area are used as indicated. The constant term is included in all the regressions. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 4: MTEF Conditional Effects on Fiscal Discipline
Dependent Variable = Central Government Balance as percentage of GDP

	(1) AB System GMM with IV and with year effects	(2) AB System GMM with IV and with year effects	(3) AB System GMM with IV and with year effects	(4) AB System GMM with IV and with year effects	(5) AB System GMM with IV and with year effects
MTFF	0.72	0.80	-0.08	0.82*	0.88*
	(0.55)	(0.75)	(1.12)	(0.43)	(0.46)
MTBF	1.08**	0.84*	2.05	0.88*	0.91*
	(0.51)	(0.50)	(1.36)	(0.52)	(0.53)
MTPF	3.08***	2.69***	0.75	2.77***	0.59
	(0.94)	(0.88)	(1.38)	(0.96)	(0.95)
MTFF x FRA	0.60				
	(0.67)				
FRA	-0.53				
	(0.53)				
MTFF x		0.03			
Political Cohesion		(0.70)			
Political Cohesion		-0.53			
		(0.43)			
Democracy			-1.27		
			(2.15)		
MTFF x			1.63		
Democracy			(2.17)		
MTBF x			-1.69		
Democracy			(2.47)		
MTPF x			2.69		
Democracy			(2.37)		
MTFF x				-0.03	
IMF Missions				(0.11)	
IMF Missions				-0.03	
				(0.08)	
MTPF x OECD					2.97**
					(1.47)
OECD					-0.39
					(0.83)
Year Effects	Y	Y	Y	Y	Y
Countries	162	148	161	162	162
Instruments	57	53	62	53	52
AR(2) test [*p*-value]	0.128	0.438	0.133	0.134	0.127
Hansen *J* [p-value]	0.251	0.203	0.511	0.362	0.544
Observations	2,605	2,254	2,587	2,605	2,605

Notes: Robust standard errors are in parentheses, clustered by country. GMM specifications use lags 1-3 of the endogenous variables with collapsed instrument matrix. Three additional instruments based on MTEF diffusion in the neighboring area are used as indicated. The constant term, Lag of GDP growth, Trade Openness, Oil Exporter, Conflict, Lag IMF Program, Population, Population Squared, Inflation, HIPC, Aid, Lag of Fiscal Discipline and the constant term are included in all the regressions. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 5: MTEF Effects on Health Spending Volatility

Dependent Variable = Absolute value of the percentage change in the deviation of the ratio of health spending to total spending from the trend component, normalized by the trend at time t-1

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Pooled OLS	FE	DID	DID with regional trends	AB System GMM	AB System GMM with IV	AB System GMM with year effects	AB System GMM with IV and with year effects	AB System GMM with IV and with year effects
MTFF	-2.88***	-1.56*	-0.60	-0.87	-1.90**	-3.06***	-1.62	-2.66***	-2.01*
	(0.59)	(0.90)	(0.99)	(0.90)	(0.96)	(0.87)	(1.04)	(0.91)	(1.06)
MTBF	-2.27**	-2.21*	-0.50	-0.75	-2.82***	-3.58***	-2.24**	-2.95***	-2.51**
	(1.08)	(1.19)	(1.19)	(1.17)	(0.88)	(0.92)	(0.96)	(0.97)	(1.03)
MTPF	-4.16***	-2.20	0.65	-1.58	-0.09	-2.84*	0.48	-2.19	-0.38
	(0.77)	(1.53)	(1.86)	(1.73)	(2.25)	(1.48)	(2.33)	(1.55)	(1.73)
Lag GDP Growth	0.09	-0.02	0.02	-0.01	0.14	0.15	0.16	0.16	0.15
	(0.13)	(0.12)	(0.11)	(0.11)	(0.13)	(0.13)	(0.13)	(0.13)	(0.13)
Trade Openness	0.00	-0.04*	-0.03	-0.05	-0.00	-0.00	-0.00	-0.00	-0.00
	(0.01)	(0.02)	(0.02)	(0.03)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Oil-Exporter	2.43*	0.73	1.45	1.68	1.56	1.28	1.91*	1.61	1.80*
	(1.25)	(2.24)	(2.16)	(2.29)	(1.01)	(1.01)	(1.05)	(1.05)	(1.01)
Conflict	1.28	2.47	1.76	1.62	1.71	1.65	1.47	1.43	1.17
	(2.40)	(2.56)	(2.59)	(2.24)	(1.74)	(1.76)	(1.71)	(1.72)	(1.79)
Lag IMF Program	1.55	0.76	0.32	0.53	1.00	0.92	1.01	0.93	0.55
	(1.04)	(1.04)	(0.99)	(1.11)	(0.91)	(0.89)	(0.90)	(0.88)	(0.79)
Population	-0.01	-0.04	0.07	0.04	-0.00	-0.00	-0.00	-0.00	-0.00
	(0.01)	(0.13)	(0.14)	(0.18)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Population Sq.	0.00	0.00	-0.00	-0.00	0.00	-0.00	-0.00	-0.00	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Inflation	0.01***	0.01***	0.01***	0.01*	0.01	0.00	0.01	0.01	0.01
	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
HIPC	-0.63	-0.55	-1.34	0.89	-0.51	-0.35	-0.93	-0.79	-0.88
	(1.58)	(1.87)	(1.92)	(1.71)	(1.45)	(1.45)	(1.43)	(1.45)	(1.42)
Aid	0.58***	0.49	0.47	0.49	0.50*	0.49*	0.52*	0.51*	0.48*
	(0.22)	(0.41)	(0.41)	(0.43)	(0.28)	(0.28)	(0.28)	(0.28)	(0.29)
Lag Volatility					0.28***	0.28***	0.26***	0.27***	0.26***
					(0.07)	(0.06)	(0.06)	(0.06)	(0.06)
Lag Credit Market Access									-1.64
									(1.11)
Fixed Effects	N	Y	Y	Y	-	-	-	-	-
Year Effects	N	N	Y	N	N	N	Y	Y	Y
Countries	172	172	172	172	172	172	172	172	172
Instruments	-	-	-	-	27	30	38	41	42
AR(2) test [*p*-value]	-	-	-	-	0.723	0.734	0.786	0.761	0.777
Hansen *J* [p-value]	-	-	-	-	0.646	0.301	0.455	0.214	0.271
Observations	2,047	2,047	2,047	2,047	1,882	1,882	1,882	1,882	1,882
R-sq.	0.13	0.33	0.34	0.35	-	-	-	-	-

Notes: Cross-sectional regressions are based on averaged data over the sample period 1990-2008. For panel regressions, robust standard errors are in parentheses, clustered by country. GMM specifications use lags 1-3 of the endogenous variables with collapsed instrument matrix. Three additional instruments based on MTEF diffusion in the neighboring area are used as indicated. The constant term is included in all the regressions. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 6: MTEF Effects on Productive Spending

Dependent Variable = General government expenditure on health as a percentage of total government expenditure

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Pooled OLS	FE	DID	DID with regional trends	AB System GMM	AB System GMM with IV	AB System GMM with year effects	AB System GMM with IV and with year effects	AB System GMM with IV and with year effects
MTFF	1.81***	0.39*	0.06	-0.04	0.17	0.26**	0.14	0.40***	0.20
	(0.40)	(0.24)	(0.28)	(0.24)	(0.15)	(0.12)	(0.17)	(0.13)	(0.14)
MTBF	2.20***	1.02***	0.58	0.30	0.38*	0.33**	0.36	0.48***	0.39**
	(0.75)	(0.32)	(0.36)	(0.32)	(0.21)	(0.14)	(0.24)	(0.16)	(0.19)
MTPF	2.82***	1.56***	0.84	0.10	0.28	0.85**	0.25	1.04***	0.51
	(0.68)	(0.48)	(0.56)	(0.64)	(0.43)	(0.37)	(0.42)	(0.37)	(0.38)
Lag GDP Growth	-0.05	-0.01	-0.02	-0.00	0.02	0.03**	0.02	0.03**	0.03*
	(0.03)	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Trade Openness	-0.01	0.00	0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00
	(0.01)	(0.01)	(0.01)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Oil-Exporter	-2.59***	-0.17	-0.29	0.02	-0.89***	-0.53***	-0.87***	-0.52**	-0.70***
	(0.68)	(0.30)	(0.33)	(0.41)	(0.26)	(0.20)	(0.26)	(0.21)	(0.25)
Conflict	-1.42*	-0.20	-0.09	-0.03	-0.28	-0.12	-0.27	-0.14	-0.07
	(0.74)	(0.32)	(0.33)	(0.29)	(0.22)	(0.20)	(0.22)	(0.20)	(0.20)
Lag IMF Program	-0.59	-0.18	-0.14	-0.12	-0.24*	-0.14	-0.23*	-0.15	-0.00
	(0.46)	(0.25)	(0.26)	(0.24)	(0.14)	(0.11)	(0.14)	(0.11)	(0.12)
Population	-0.02*	0.03	0.00	-0.03	-0.00	-0.00	-0.00	-0.00	-0.00
	(0.01)	(0.03)	(0.03)	(0.03)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Population Sq.	0.00*	-0.00*	-0.00	0.00	0.00	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Inflation	-0.00**	-0.00**	-0.00	-0.00	-0.00	0.00	-0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
HIPC	1.06	0.64	0.56	0.35	0.29	0.16	0.24	0.12	0.19
	(0.78)	(0.63)	(0.62)	(0.62)	(0.29)	(0.26)	(0.28)	(0.26)	(0.27)
Aid	-0.10*	0.01	0.02	0.02	-0.01	0.01	-0.01	0.01	0.01
	(0.05)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)
Lag Productive Spending					0.72***	0.85***	0.73***	0.84***	0.79***
					(0.04)	(0.03)	(0.04)	(0.04)	(0.04)
Lag Credit Market Access									0.74***
									(0.19)
Fixed Effects	N	Y	Y	Y	-	-	-	-	-
Year Effects	N	N	Y	N	N	N	Y	Y	Y
Countries	172	172	172	172	172	172	172	172	172
Instruments	-	-	-	-	55	58	67	70	71
AR(2) test [*p*-value]	-	-	-	-	0.635	0.600	0.702	0.680	0.691
Hansen *J* [p-value]	-	-	-	-	0.384	0.173	0.667	0.204	0.253
Observations	2,209	2,209	2,209	2,209	2,047	2,047	2,047	2,047	2,047
R-sq.	0.14	0.84	0.85	0.86	-	-	-	-	-

Notes: Robust standard errors are in parentheses, clustered by country. GMM specifications use lags 1-10 of the endogenous variables with collapsed instrument matrix. Three additional instruments based on MTEF diffusion in the neighboring area are used as indicated. The constant term is included in all the regressions. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 7: MTEF Effects on Technical Efficiency

Dependent Variable = Estimations of the efficiency scores from a stochastic frontier model that shows life expectancy as output

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Pooled OLS	FE	DID	DID with regional trends	AB System GMM	AB System GMM with IV	AB System GMM with year effects	AB System GMM with IV and with year effects	AB System GMM with IV and with year effects
MTFF	-0.13	-0.37	-0.54**	-0.25	-0.12	-0.02	0.10	0.11	0.03
	(0.96)	(0.25)	(0.26)	(0.21)	(0.13)	(0.11)	(0.16)	(0.13)	(0.14)
MTBF	-5.29***	-0.54	-0.77*	-0.56	-0.19	-0.10	0.07	0.07	0.01
	(1.50)	(0.42)	(0.45)	(0.36)	(0.18)	(0.15)	(0.21)	(0.17)	(0.18)
MTPF	-1.28	-0.10	-0.45	0.41	0.28	0.42**	0.61**	0.51***	0.38*
	(1.93)	(0.83)	(0.86)	(0.85)	(0.27)	(0.20)	(0.25)	(0.19)	(0.23)
Lag GDP Growth	-0.11	-0.05***	-0.06***	-0.06***	-0.00	-0.01	0.00	-0.00	-0.00
	(0.08)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Trade Openness	-0.02	0.00	-0.00	-0.01	0.00	0.00	0.00	-0.00	-0.00
	(0.01)	(0.01)	(0.01)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Oil-Exporter	-6.95***	-1.50***	-1.61***	-0.96***	0.11	0.04	0.17	0.06	0.02
	(2.15)	(0.58)	(0.56)	(0.22)	(0.17)	(0.15)	(0.17)	(0.15)	(0.15)
Conflict	-0.00	0.37	0.40	0.30	0.11	0.13	0.03	0.04	0.06
	(1.34)	(0.30)	(0.29)	(0.27)	(0.33)	(0.31)	(0.31)	(0.30)	(0.30)
Lag IMF Program	-0.21	0.13	0.09	0.15	-0.01	-0.03	-0.04	-0.07	-0.04
	(0.89)	(0.24)	(0.25)	(0.21)	(0.08)	(0.07)	(0.08)	(0.07)	(0.07)
Population	-0.01	0.03	0.00	-0.01	0.00	0.00	0.00	0.00	0.00
	(0.01)	(0.07)	(0.07)	(0.07)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Population Sq.	0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Inflation	-0.01***	0.00	0.00**	-0.00	0.00	0.00	0.00**	0.00*	0.00*
	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
HIPC	-6.80***	-0.12	-0.07	0.09	0.28*	0.16	0.20	0.09	0.08
	(1.57)	(0.34)	(0.34)	(0.25)	(0.15)	(0.15)	(0.14)	(0.15)	(0.15)
Aid	-0.14	0.05*	0.05*	0.05	0.01	0.01	0.02	0.02	0.02
	(0.09)	(0.03)	(0.03)	(0.03)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Lag Technical Efficiency					1.06***	1.04***	1.06***	1.04***	1.04***
					(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Lag Credit Market Access									0.10
									(0.10)
Fixed Effects	N	Y	Y	Y	-	-	-	-	-
Year Effects	N	N	Y	N	N	N	Y	Y	Y
Countries	164	164	164	164	161	161	161	161	161
Instruments	-	-	-	-	103	106	111	114	115
AR(2) test [*p*-value]	-	-	-	-	0.522	0.459	0.628	0.592	0.644
Hansen *J* [p-value]	-	-	-	-	0.057	0.051	0.176	0.164	0.155
Observations	1,317	1,317	1,317	1,317	1,157	1,157	1,157	1,157	1,157
R-sq.	0.21	0.98	0.98	0.98	-	-	-	-	-

Notes: The technical efficiency scores are based on estimating the production function $[\![LifeExpectancy]\!]\_it = \alpha + \beta[\![HealthSpending\_pc\_PPP]\!]\_it + \gamma[\![Covariates]\!]\_it + \tau\_t + v\_it - u\_it$, where the group of covariates includes population density, years of schooling, a government indicator for voice and accountability, and one for government effectiveness, a dummy variable for OECD countries and year effects. Robust standard errors are in parentheses, clustered by country. GMM specifications use lags 1-2 of the endogenous variables with collapsed instrument matrix. Three additional instruments based on MTEF diffusion in the neighboring area are used as indicated. The constant term is included in all the regressions. * significant at 10%; ** significant at 5%; *** significant at 1%.

Figure 1: Global MTEF Adoption, 1990-2008

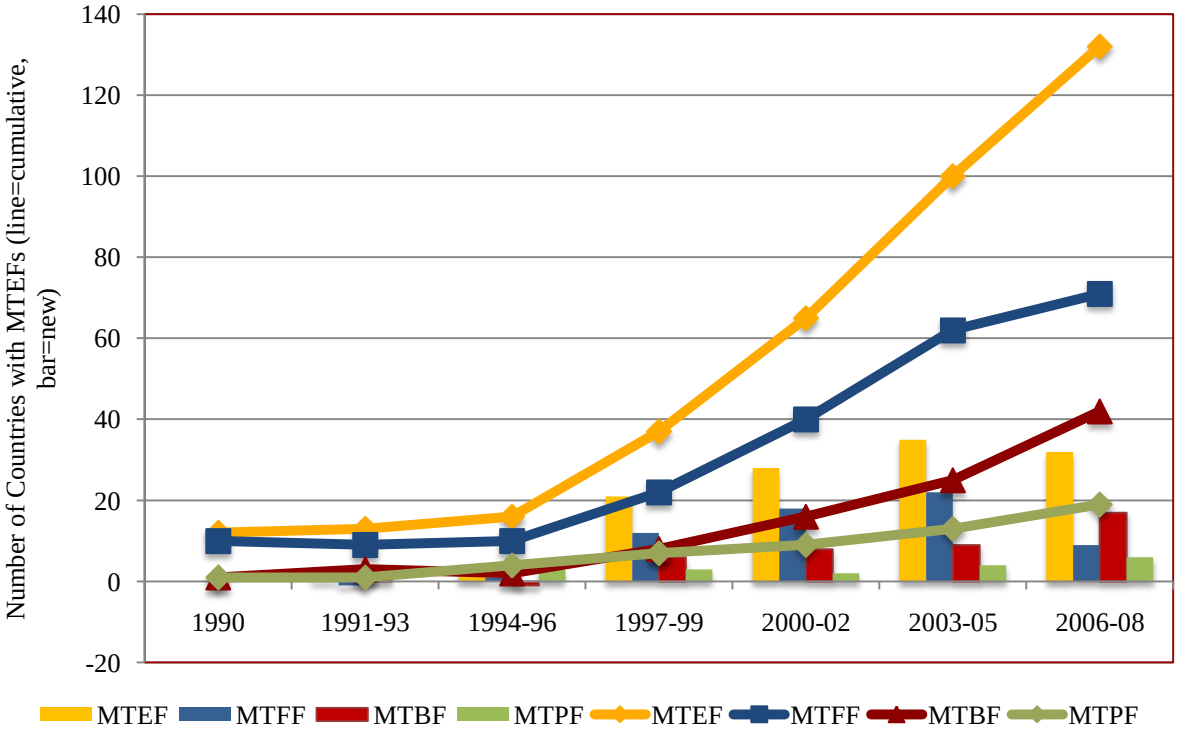


Figure 2: MTEF Adoption in Advanced Economies and by Developing Country Region, 2008

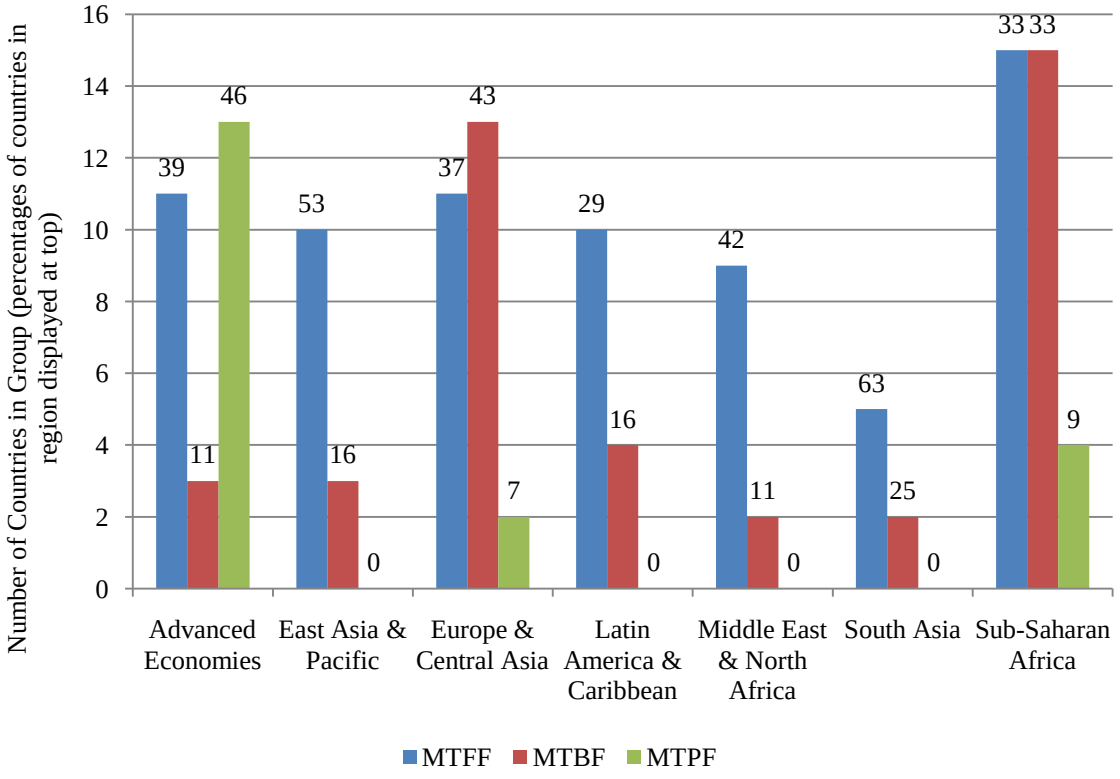
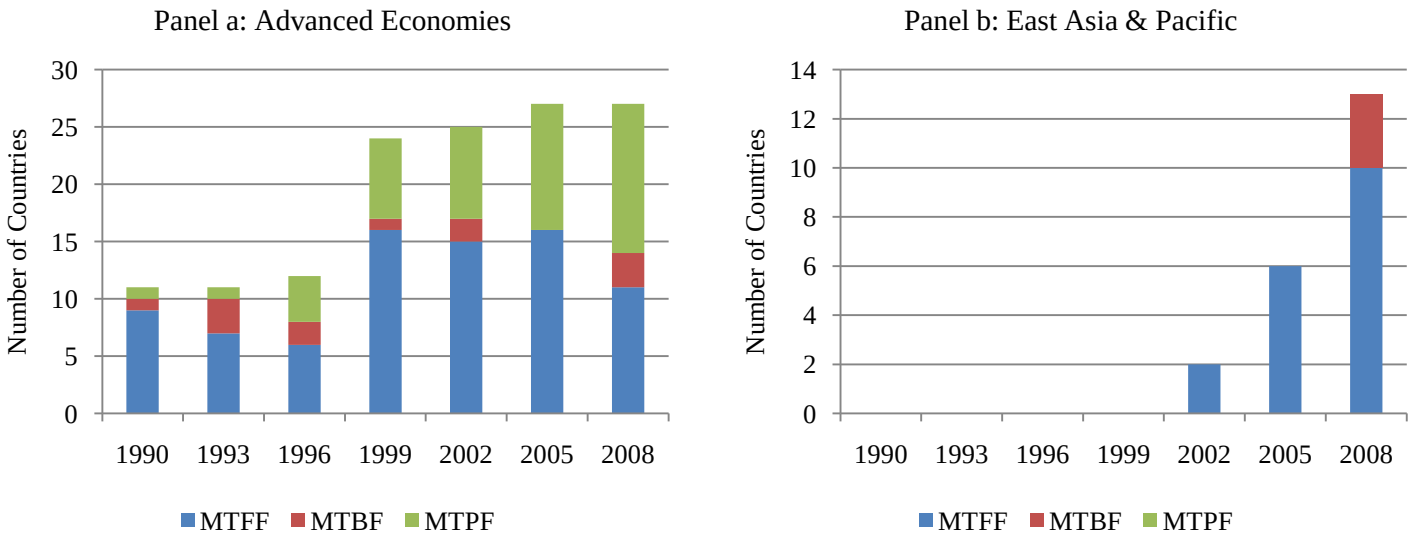
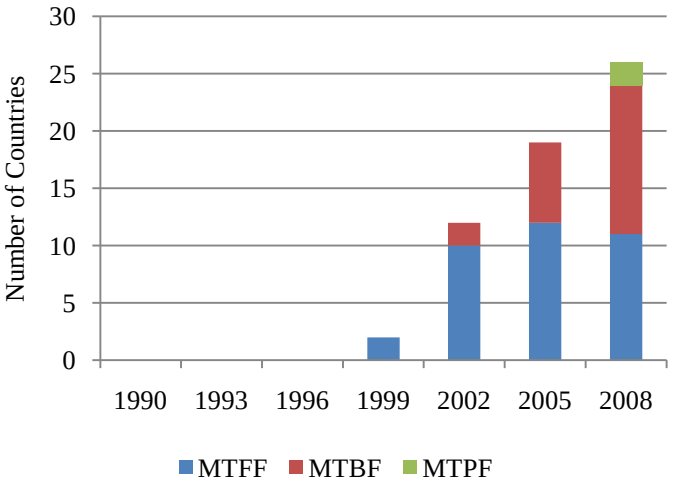


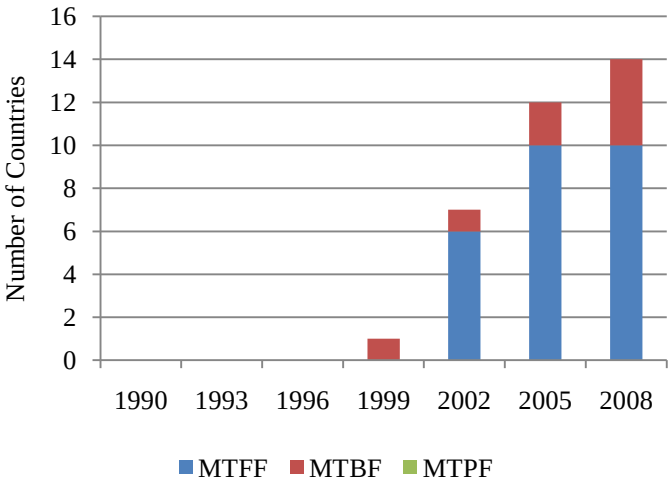
Figure 3: MTEF Adoption in Advanced Economies and by Developing Country Region, 1990-2008



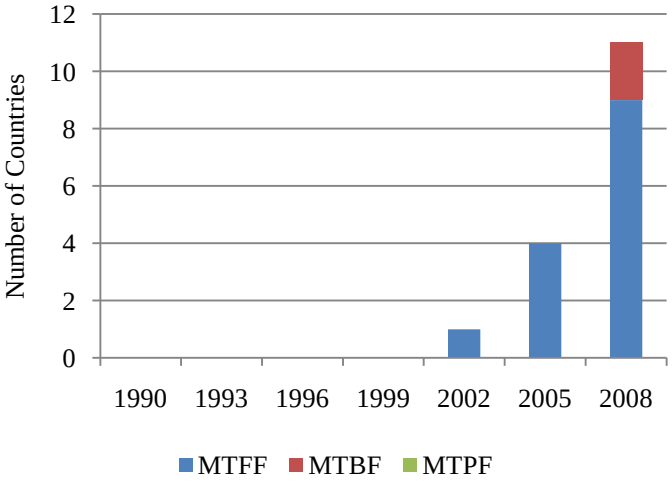
Panel c: Europe & Central Asia



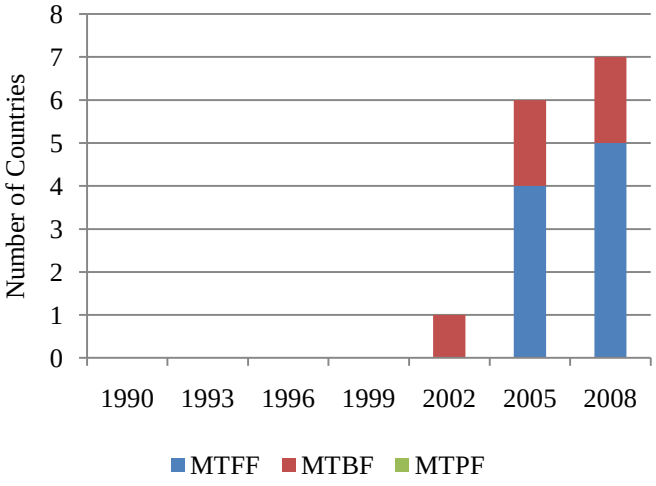
Panel d: Latin America & Caribbean



Panel e: Middle East & North Africa



Panel f: South Asia



Panel g: Sub-Saharan Africa

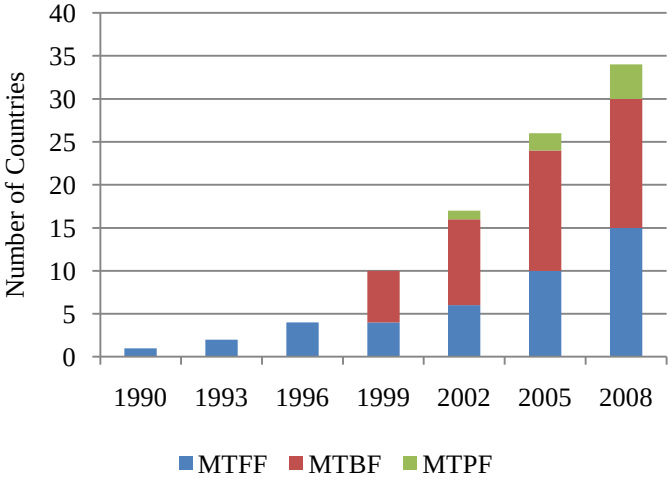


Figure 4: MTEF Adoption in Europe, 1990-2008

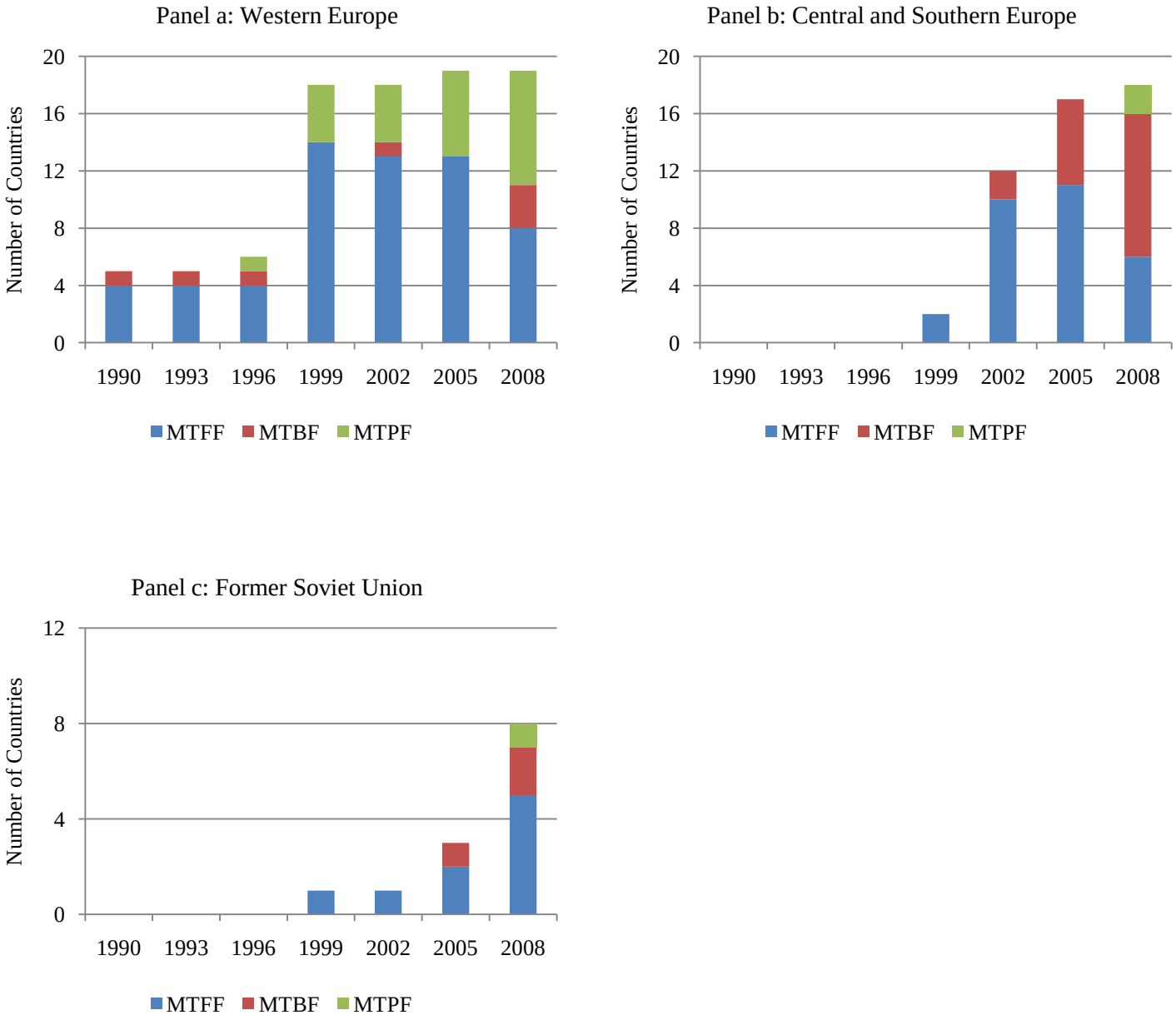


Figure 5: MTEF Adoption in Africa, 1990-2008

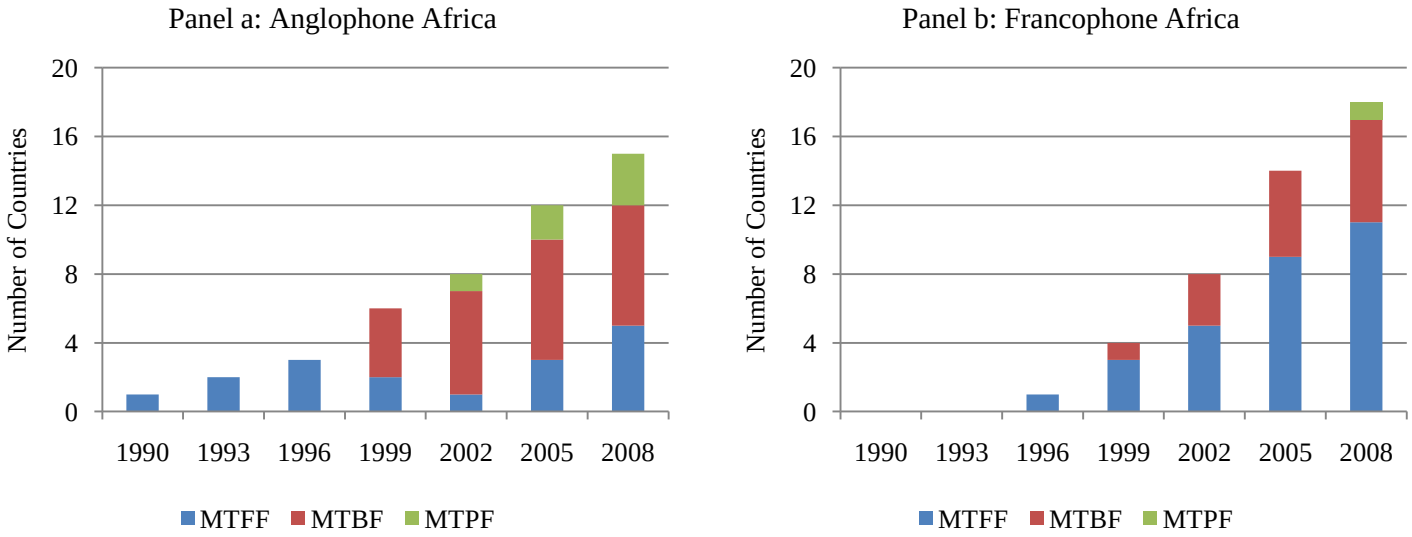


Figure 6: MTEF Adoption by Income Group, 1990-2008

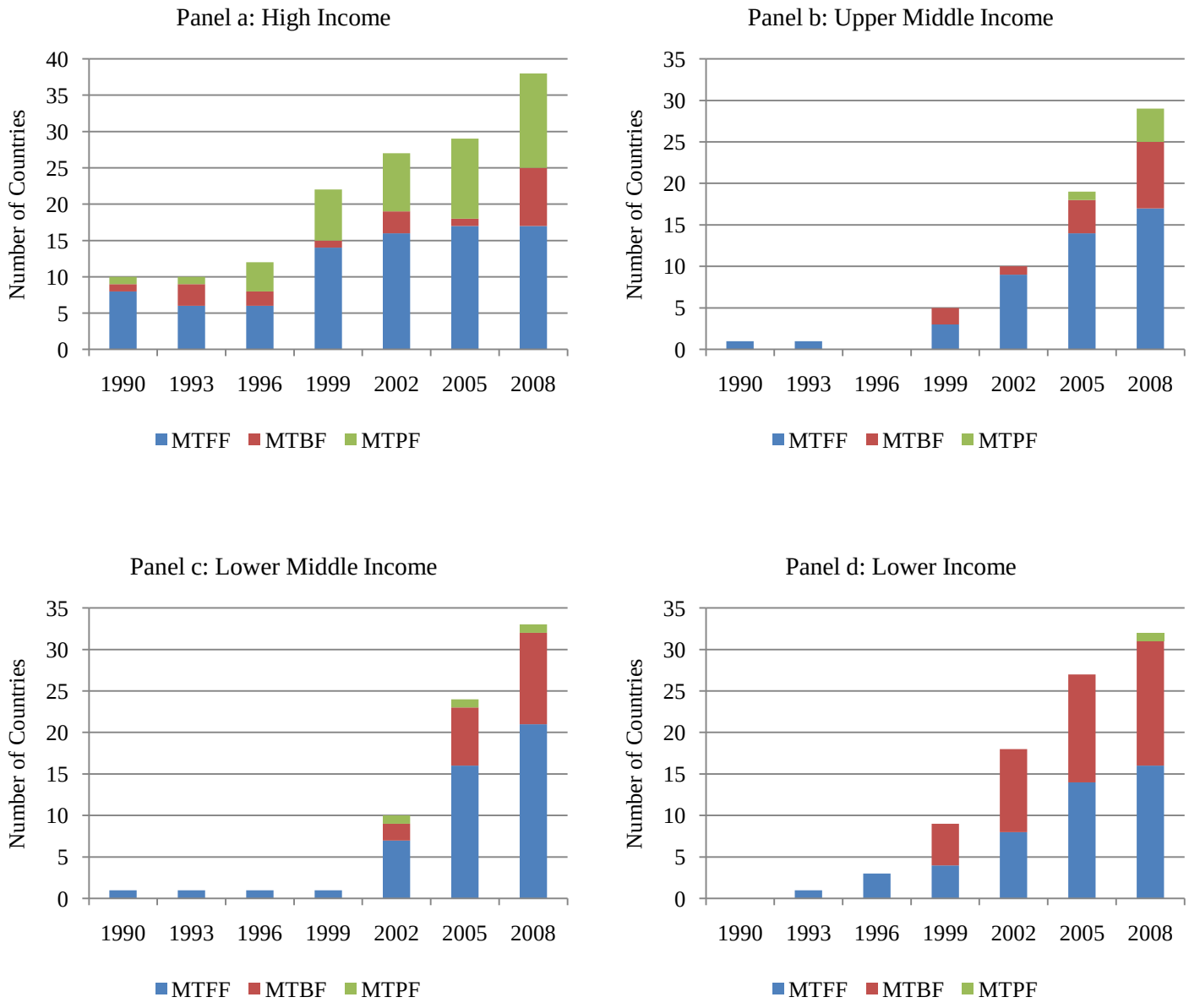


Figure 7: MTEFs and Fiscal Discipline

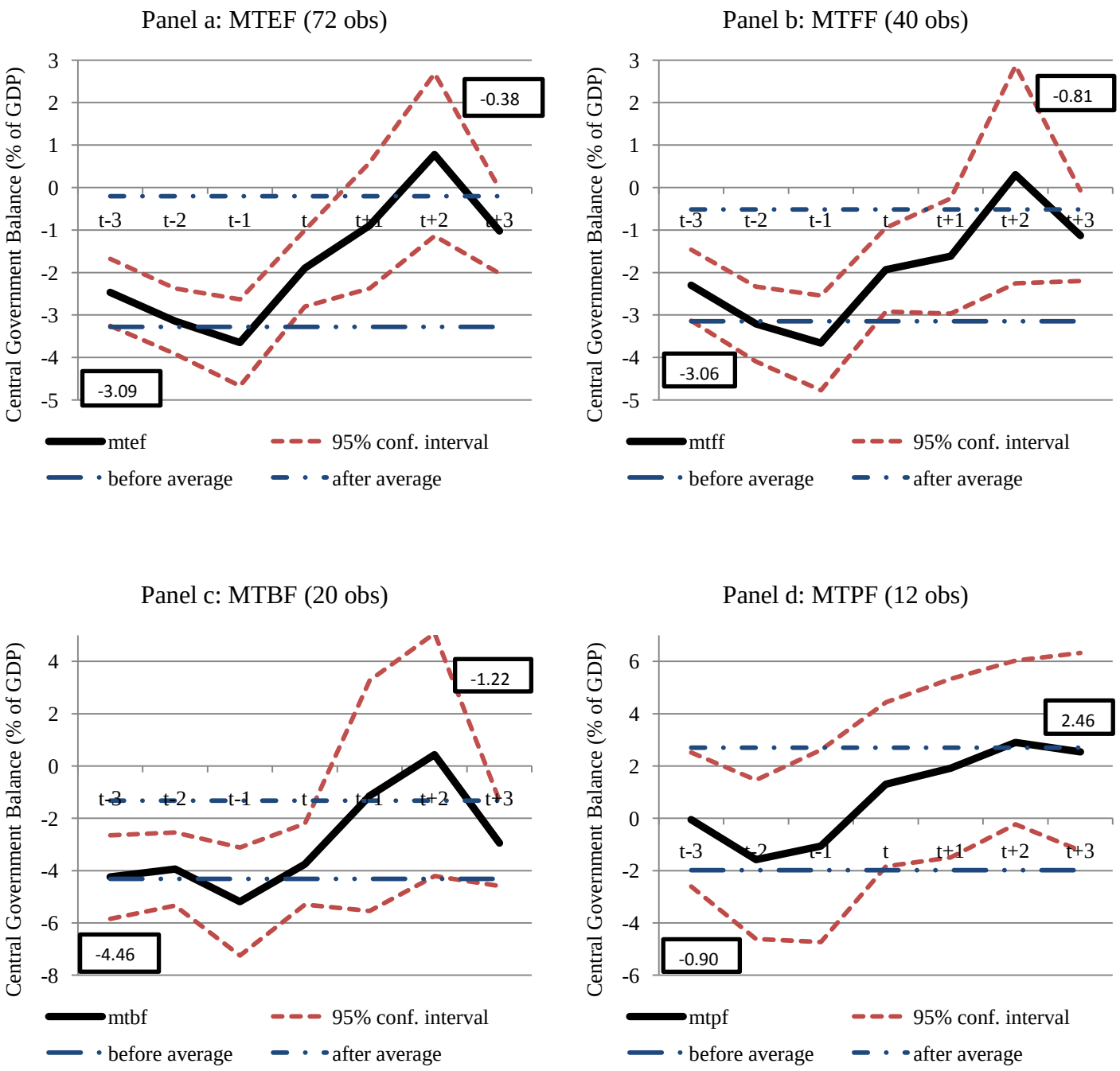


Figure 8: MTEFs and Health Expenditure Volatility

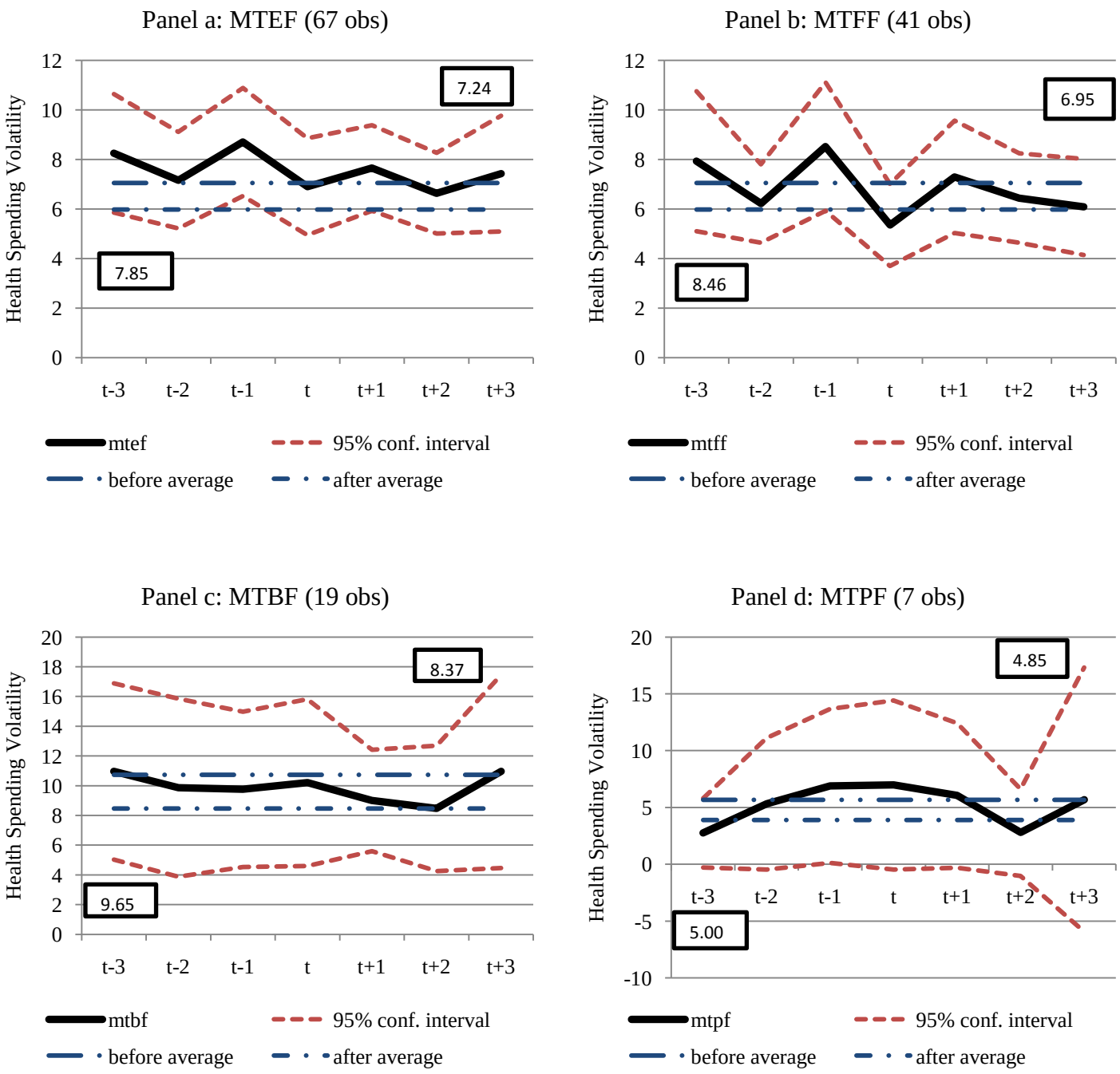


Figure 9: MTEFs and Productive Spending

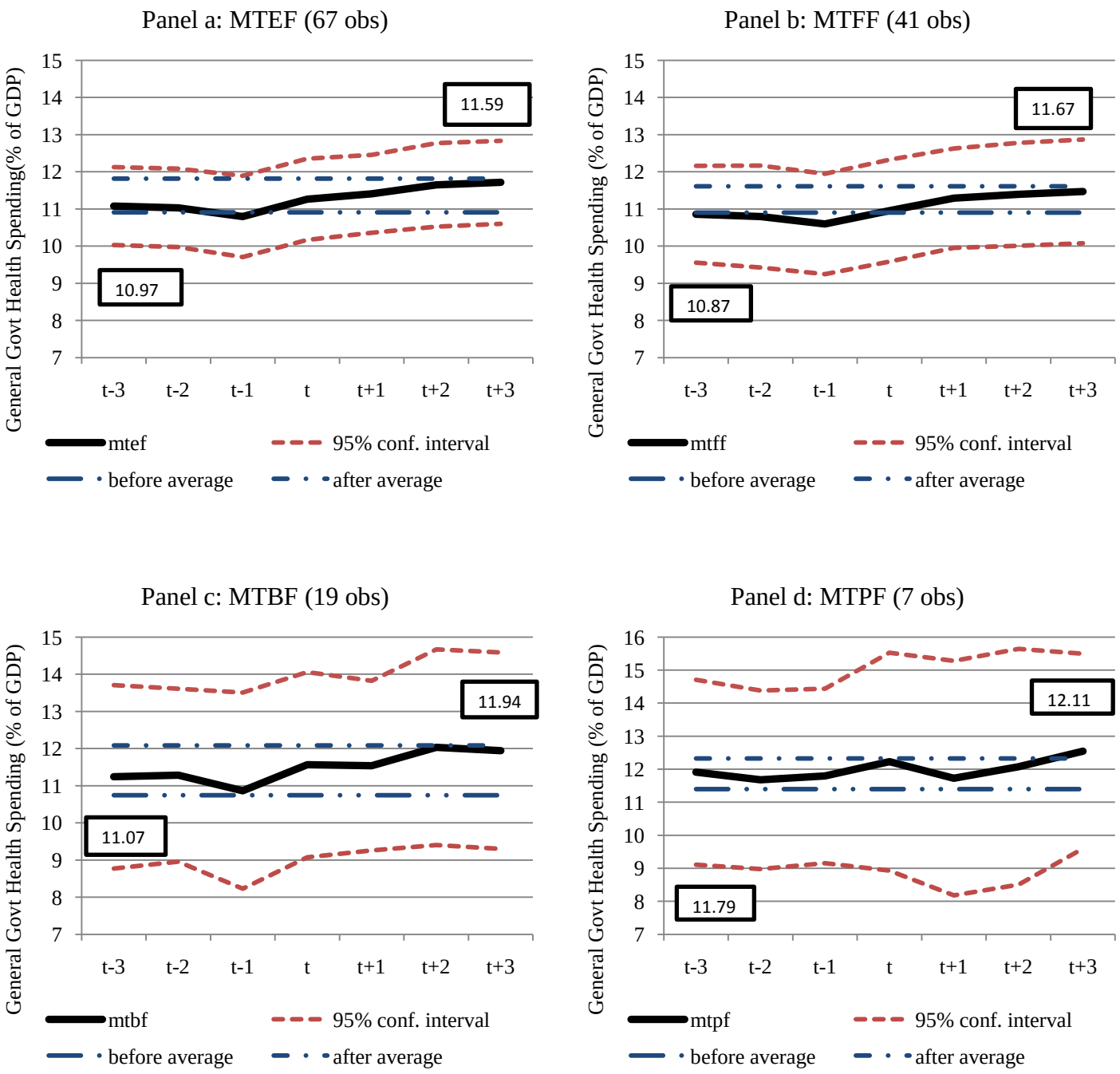
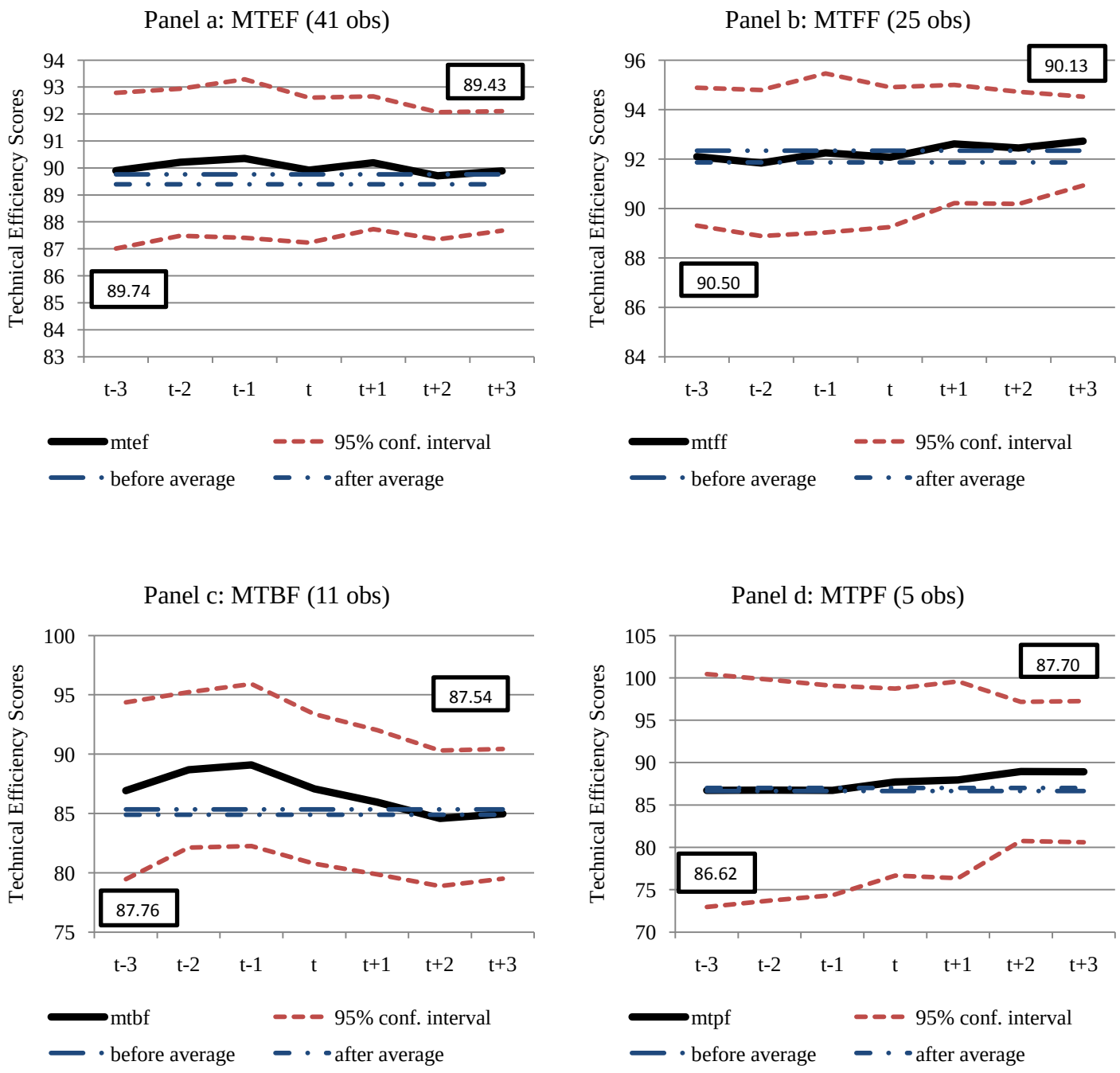


Figure 10: MTEFs and Technical Efficiency



Chapter 3: Commodity Prices, Consumer Goods' Prices and Money Balances

Abstract

This paper aims to identify the nexus between the excess of liquidity in the United States and commodity prices over the 1983-2006 period. In particular, it assesses whether commodity prices react more powerfully than consumer goods' prices to changes in real money balances. Within a cointegrated vector autoregressive framework, the author investigates whether consumer prices and commodity prices react to excess liquidity, and if the different price elasticities of supply for goods and commodities allow for differences in the dynamic paths of price adjustment to a liquidity shock. The results show a positive relationship between real money and real commodity prices and provide empirical evidence for a stronger response of commodity prices with respect to consumer goods' prices. This could imply that, if the magnitude of the reaction is due the fact that consumer goods' prices are slower to react, then their long-run value can be predicted with the help of commodity prices.The findings support the view that the latter should be considered as a valid monetary indicator.[1]

[1] The author wishes to thank Katarina Juselius and Morten Tabor for their kind support in carrying out the econometric analysis. A special thank to the participants to the Summer School at the University of Copenhagen for providing me with important comments. Note that all mistakes and opinions expressed in the paper belong to the author only.

1. Introduction

In the last four decades, the volatility of commodity prices generated turbulence in the global economy, affecting importing and exporting countries in opposite and vigorous ways. Nonetheless, the attention of the literature to the topic seemed to be proportional to price growth, declining in relatively tranquil periods and rising when the commodities prices were back at high levels. The huge variations of the last decade generated a renewed interest in the topic.

In the 1970s, the popular view was that commodity prices were defined as a result of evolution in the relevant commodity market, playing an important role in the stagflation of that decade. However, this idea has been strongly challenged. An increase in the expected inflation rate due, for example, to an increase in money supply causes agents to shift from money to commodities, provoking a rise in prices. Therefore, increases in the price of oil and other commodities could be the result of an exceedingly expansionary policy, rather than an exogenous inflationary supply shock.

Falling commodity prices in the 1980s and 1990s were not considered as interesting as raising prices, even though oil producers such as Mexico and Russia were experiencing important revenue losses and countries such as Argentina, Brazil and Australia were suffering from low agricultural prices.

After collapsing in the second half of 2008, commodity prices stabilized in early 2009 and subsequently staged a comeback. Such behavior is in contrast with what happened during past recessions. In previous global downturns, prices typically continued to fall into the early phases of recovery or rose at rates far below the increases recorded in recent months. An exception is the price of oil, which recorded meaningful increases early in previous recoveries.

Thus, the recent happenings of quick commodity price increases and higher volatility following the easy monetary stance in the US, matched with similar accommodative policies in the euro area and Japan, led some to infer some causal role for monetary changes in driving commodity prices and ultimately inflation.

Drawing on Dornbusch (1976), the idea of overshooting has been adapted to analyze theoretically the relationship between money, consumer prices and commodity prices by Frankel (1986). The latter argued that tightening monetary policy has relevant effects on commodity prices because they are flexible, whereas other goods' prices are sticky. Thus, commodity prices overshoot their new equilibrium in the short-run in order to generate an expectation of future appreciation sufficient to offset the higher interest rate.

This paper aims at identifying the nexus between the excess of liquidity in the United States and commodity prices over the 1983-2006 period. In particular, it tests whether the latter react more powerfully than consumer goods' prices to changes in real money balances.

Within a cointegrated VAR framework, it is investigated whether consumer prices and commodity prices react to excess liquidity in the US, and if the different price elasticities of supply for goods and commodities allow for differences in the dynamic paths of price adjustment to a liquidity shock.

The results show a positive relationship between real money and real commodity prices and provide empirical evidence for a stronger response of commodity prices with respect to consumer goods' prices. This could imply that, if the magnitude of the reaction is due to the fact that consumer goods' prices are slower to react, then, their long-run value can be predicted with the help of the commodity prices.

The structure of the paper is as follows. In section 2, some contributions on the issue are presented. Section 3 describes the hypothesis to be tested. In section 4 the empirical

strategy, test results and interpretation of the findings are presented. Section 5 ends the paper reporting the conclusions.

2. A review of the literature

Before discussing the empirical analysis employed, some of the main contributions on the relationship between monetary policy, consumer prices and commodity prices will be reviewed.

Drawing on Dornbusch's exchange rate overshooting model, Frankel (1986) provides a theoretical framework to analyze the impact of money supply shocks on commodity prices. He substitutes the price of agricultural goods for the price of foreign exchange and argues that the reason for the overshooting phenomenon is that prices for agricultural and mineral products adjust rapidly, while the price of goods adjusts more slowly. In fact, the hypothesis is that commodities are exchanged in a reactive auction market in which the supply cannot be easily expanded, whereas the consumer goods market enjoys a copious supply.

Frankel illustrates the dynamic starting from a monetary contraction that is expected to be permanent and that would eventually lead to an equal fall of consumer and commodity goods' prices in the absence of other disturbances. However, given the manufactured price stickiness in the short-run the nominal money supply contraction is a reduction in the real money supply. Such a reduction should be offset by an interest rate rise. Nevertheless, the arbitrage condition implies that, since commodities are storable, the interest rate cannot grow more than the expected rate of increase in the commodity prices plus the storage cost. Therefore, the spot price of commodities must fall today and must do so until the moment in which there is an expectation of future appreciation that is sufficient to offset the higher interest rate.

Over the last three decades the role of commodity prices in setting monetary policy has been faced by many researchers. On the one hand, it has been argued that commodity prices may be an earlier indicator of the current state of the economy because, as assumed by Frenkel (1986) these prices are usually set in continuous auction markets with efficient information (see Olivera, 1970; Garner, 1989; Marquis and Cunningham, 1990; Cody and Mills, 1991). Thus, some policymakers became advocates of using commodity prices as a leading indicator of inflation and endorsed policy proposals using commodity prices as a guide to adjust short run money growth target ranges (see Garner, 1989). A rise in commodity prices may indicate to policymakers that the economy is growing too rapidly and hence inflation is inclined to rise. In such a case, the monetary authority may observe the rising commodity prices and respond by raising interest rates to tighten money supply.

On the other hand, the counterargument is that commodity prices cannot be used effectively in formulating monetary policy because they are subject to large, market-specific shocks, which may not have macroeconomic implications (see Marquis and Cunningham, 1990; Cody and Mills, 1991). However, many others (see Bessler, 1984; Pindyck and Rotemberg, 1990; Hua, 1998) argue that commodity price movements are the result of monetary or macroeconomic changes and that the causality should run from macroeconomic/monetary variables to commodity prices. Barsky and Kilian (2002) offer another important contribution. They argue that monetary expansions and contractions could generate stagflation of important magnitudes, by providing evidence about the role of monetary fluctuations in determining the prices of oil and, in particular, the prices of industrial commodities that preceded the 1973 oil price increase. Bernanke et al. (1997) investigate the relationship between the oil price shocks, US monetary policy and the business cycle. They assert that a relevant part of the effect of oil price shocks on the

economy comes from tighter monetary policy resulting from the change in oil prices and not from the change in oil prices *per se*.

Another piece of literature analyzes the impact of the commodity price evolutions on the behavior of monetary policy and its informational role for formulating it. Awokuse and Yang (2003) argue that commodity price indicators contain important information about the future movements of macroeconomic variables. Bhar and Hamori (2008) assess the information content of commodity prices for monetary policy. Using a cross correlation approach between economic activity and commodity futures prices, they affirm that commodity prices can serve as suitable information for monetary policy.

Fuhrer and Moore (1992) investigate the relationships between asset prices and inflation in a Keynesian model in which monetary policy controls inflation by manipulating the federal funds rate. They find that the indicator properties of asset prices are quite sensitive to the monetary policy rule. Hamori (2007) empirically analyzes the relationship between the commodity prices index and macroeconomic variables in Japan, arguing that the former and the general price level are closely related, with movements in commodity prices leading movements in the general price level. However, he specifies that the commodity price index was found to be valid as a leading indicator of the consumer price index before the zero interest policy was introduced, as afterwards the relationship ceased to exist.

Other studies, such as Surrey (1989), Boughton and Branson (1990, 1991), and Browne and Cronin (2007), investigate empirically the potential importance of monetary conditions on the relationship between commodity prices and consumer goods' prices. However, they all use different empirical techniques or different specifications from the one employed in this paper.

3. A Model of Price Dynamics

This section presents the theoretical framework through which the investigation aims to answer the following research question: do commodity prices react more strongly than consumer goods' prices?

As mentioned, the commodity price overshooting theory was advanced by Frankel (1986). The essence of this theoretical framework is that the short-term reaction to an expansionary monetary policy produces an overshoot of the commodity prices and a more delayed reaction in the consumer goods market. In the long-run, consumer prices adjust to the new equilibrium. However, Frenkel's theory is fundamentally based on the assumption that commodity prices react more strongly in the short-run than the consumer goods' prices.

In order to test the hypothesis it is allowed for a two-good economy, and commodities and consumer goods with prices p^{COM} and p^{CPI}, respectively. The substantial difference between these two goods is that consumer prices are decided in a market with a supply that adjusts to the changes in demand, while the commodity prices are decided in a market restricted in supply and with high transaction costs, due to transportation expenses. Therefore, consumer goods' prices are sticky, whereas commodity prices are not.

The rationale for this assumption can be found in the current scenario where many low-cost producers (especially in developing countries) are generating additional supply of consumer goods, while commodity supply is constrained by natural factors. Furthermore, the speed of the adjustment depends on the fact that participants in the commodity markets are usually more equally informed than their consumer goods' counterparts.

Graphically, the two markets can be represented as in Figure 1:

[Figure 1 about here]

Figure 1 shows the price-quantity changes as a result of a monetary expansion in markets with high (left graph) and low (right graph) price elasticity of supply. The aggregated supply of price elastic goods in the short-run is characterized by infinite price elasticity so that additional demand brought about by a liquidity shock (from D to D') can be satisfied without any price increase. Consequently, the liquidity shock translates into an increase in output achieving a new short-run equilibrium at p'^{CPI}. In contrast, goods characterized by restrictions in supply, cannot be expanded easily and are thus quantity-insensitive to a monetary expansion. Additional demand is then fully reflected in a rise in commodity prices.

In the long-run, prices will also react on the price elastic goods market if the well-documented neutrality of money holds; any change in money supply is met with a proportional change in the price level that keeps real money and real output in both markets unchanged.

More formally, the general price level is:

$$p = \lambda p^{COM} + (1 - \lambda)p^{CPI},\ 0 < \lambda < 1 \tag{1}$$

A once-off increase of μ percent in the money supply in period t produces an increase in the general price level by $(1 + \mu_t)p_{t-1}$. However, given the initial assumption, such increase fully translates into the commodity price p^{COM}, because p^{CPI} is sticky. Thus, the price relationship at time t will be:

$$p_t = \lambda p_t^{COM} + (1 - \lambda)p_{t-1}^{CPI} \tag{2}$$

Assuming no further changes in the money supply in period $t+1$, the general level of prices at time $t+1$ will be the same as in t.

$$p_{t+1} = \lambda p_{t+1}^{COM} + (1-\lambda) p_{t+1}^{CPI} \tag{3}$$

This allows setting the right hand side of Equation 2 to be equal to the right end side of Equation 3.

$$\lambda p_t^{COM} + (1-\lambda) p_{t-1}^{CPI} = \lambda p_{t+1}^{COM} + (1-\lambda) p_{t+1}^{CPI} \tag{4}$$

As $p_{t-1}^{CPI} = p_t^{CPI}$ and $p_{t+1}^{COM} = (1+\mu_t) p_{t-1}^{COM}$, after some algebra the following equation is obtained:

$$p_{t+1}^{CPI} - p_t^{CPI} = [\lambda(1-\lambda)][p_t^{COM} - (1+\mu_t) p_{t-1}^{COM}] \tag{5}$$

The different dynamics of the adjustment processes implies that the size of the change of the consumer goods' prices in period t can be predicted by observing the spread between the current period price of the commodities (p_t^{COM}) and the equilibrium value to which it must adjust in period $t+1$, ($\left(1+\mu_t\right) p_{t-1}^{COM}$), which is dependent on the monetary shock in the current period (μ_t).

4. Empirical Analysis

First, this section documents the strategy chosen for the analysis and the data used and describe s the empirical analysis. Secondly, the results from the estimation of the model are presented and discussed.

4.1. Empirical Strategy

The analysis is carried out using a cointegrated VAR model. Formally the model is six dimensional VAR with independent and identically-distributed Gaussian errors:

$$X_t = \mathrm{A}_1 X_{t-1} + \cdots + \mathrm{A}_k X_{t-k} + \Phi D_t + \varepsilon_t, \, t = 1, \ldots T \tag{6}$$

where X_t is the following vector of variables:

$$X_t = \begin{bmatrix} y^r \\ m^r \\ i_m \\ i_b \\ \Delta P \\ CRB - CPI \end{bmatrix} \tag{7}$$

Namely real output, real money, short term and long term interest rates, inflation and real commodity prices, and D_t is a vector of deterministic components.

The Vector Error Correction Model (VECM) representation of the VAR model combines levels and differences as follows:

$$X_t = \Pi X_{t-1} + \Gamma_1 \Delta X_{t-1} + \cdots + \Gamma_{k-1} \Delta X_{t-k-1} + \Phi D_t + \varepsilon_t, \, t = 1, \ldots T \tag{8}$$

where Π are the effects in the long-run and Γ_1 contains the short-run information. The inconsistency with the X_t integrated of order one is solved by transforming the multivariate model and reducing the rank of Π to $r < p$ with p being the number of variables. The reduced rank matrix can be factorized into two rxp matrices α and β ($\Pi = \alpha\beta'$). The factorization provides r stationary linear combinations of the variables called cointegrating vectors, and $p - r$ common stochastic trends of the system.

Within a cointegrated VAR framework, the common shocks, or common stochastic trends, are hitting all the variables simultaneously. Since an impulse response analysis implies assuming a certain structure of shocks, namely that one variable is exclusively hitting the variable we are interested in, this has been neglected as such assumption cannot be tested (see Juselius, 2006).

4.2. Data and Unit Root Tests

The choice of the country has to do with the fact that, even if the US accounts for less than one third of world GDP, its importance in the monetary and financial system is evidently higher than that. The period under analysis goes from the first quarter of 1983, to the first quarter of 2008. Such span corresponds to a fairly stable period in terms of inflation growth.

As an indicator of the nominal money supply, data on the M2 aggregate have been downloaded from the International Financial Statistics (IFS) dataset, as well as data on nominal gross domestic product (GDP), consumer price index (CPI), 3-month Treasury bill rate and 10-years government bond yield. As a proxy for the commodity prices the Commodity Research Bureau (CRB) index has been adopted. This index measures the combined movements in the prices of 22 basic commodities whose markets are assumed to be among the first to be influenced by changes in economic conditions and therefore by the monetary policy.

In order to perform an I(1) analysis, a nominal to real transformation has been performed. Since nominal GDP and nominal money supply show clear features of I(2) processes, they have been considered in real terms. Likewise, some transformations have been done on price indexes. On the one hand, inflation has been considered instead of the CPI index (typically I(2)); on the other hand, the difference between the CRB index and the CPI index has been taken (real commodity prices hereafter).

Real money, real GDP, inflation and real commodity prices have been taken in logs. The interest rates have been transformed into quarterly rates. Table 1 presents some descriptive statistics of the variables considered[2].

[Table1 about here]

The unit root properties of the series are tentatively investigated using two unit root tests. The first unit root test performed is the Augmented Dickey-Fuller (ADF) test, for which stationarity serves as the null hypothesis. However, it should be noted that the ADF test could fail to distinguish between a unit root and a near unit root process and it can happen that indicates that a series contains a unit root when it does not (Perron 1989). Thus, a second unit root test is adopted, namely the Kwiatkowsk, Phillips, Schmidt and Shin (KPSS) test, for which the null hypothesis is non-stationarity.

[2] Note that for both the CPI and CRB index the value 100 is given to the first quarter of 1983.

[Table 2 about here]

As shown in Table 2, the results from both the tests employed confirm that all the variables in the system are integrated of order one at 5% significance level. Nonetheless, it should be remembered that such tests are not reliable in the presence of breaks or shifts in the series.

Figure 2 and 3 show the graphs of the series in levels and first differences.

[Figure 2 about here]

[Figure 3 about here]

A graphical inspection of the data reveals that the assumption of constant mean does not seem appropriate for the level of the variables, whereas it does much more so for the differenced series. The assumption of constant variance seems to be approximately satisfied for the differences, even though some variability can be observed in most of the series. In order to account for the biggest departures from assumptions, three permanent blip dummies have been added to the model in correspondence of the biggest residuals. The first one takes the value one during the fourth quarter of 1984, when Ronal Reagan was re-elected as President of the US. The second one controls for the dramatic slump in inflation during the

second quarter of 2006, probably due to an unexpected plunge in energy prices. The last dummy controls for the economic impacts of the terrorists attack of September 11, 2001.

Moreover, it is worth noting that the graph of the real money shows two breaks in trend. A constant increase in the variable is observed from the beginning of the sample until 1987. A period of approximately zero growth follows and lasts until 1995, when it starts increasing as fast as in the first period. Thus, the slope of the two growing trends seems to be roughly the same. Even though the introduction of two breaks has been attempted, it turned out more satisfactory to allow for trends in the levels. This should have the effect of averaging out the aforementioned breaks. Moreover, since it is not possible to know *a priori* whether these trends cancel out in the cointegrating relations, the chosen specification allows these to be trend-stationary and have non-zero intercepts.

4.3. Lag Length Selection and Residual Analysis

Table 3 shows that the Schwartz criterion (SC) suggests $k = 1$ and the Hannan-Quinn (HQ) criterion suggests $k = 2$. However, when imposing $k = 1$ the other misspecifications tests become much worse, implying that the SC might have penalized too much. The LM tests in the last two columns show the left-over residual autocorrelation in each VAR(k) model and seem to accept the absence of autocorrelation for the VAR with 2 lags.

[Table 3 about here]

Table 4 presents the results of the multivariate residual analysis. In particular the null hypothesis of no autocorrelation is rejected at both the first and the second lag. Given the

relatively small sample, it is not advisable to rely on the asymptotic properties of the estimator, thus the normality assumption turns out to be relevant and it is safely accepted. Lastly the null hypothesis of no ARCH effects is accepted at both lags.

[Table 4 about here]

Table 5 shows the results of the univariate residual analysis. The output of the ARCH and Normality tests reflect the good results of the multivariate analysis. The skewness and kurtosis statistics are close to the normal distribution values, suggesting that by inserting the three blip dummies the biggest outliers should have been controlled for.

[Table 5 about here]

Overall, both the multivariate and univariate tests suggest that the residuals are well behaved and therefore that the model is well specified.

4.4. Rank Determination

The cointegration rank is determined according to Johansen (1996) LR Trace test. When the sample is small, the asymptotic distributions are generally poor approximations to the true distributions. To secure a correct test size one can apply the small sample Bartlett

corrections developed in Johansen (2002). The asymptotic distribution of the rank test statistic differs depending on the deterministic components in the model and on almost any type of dummy variable[3]. Therefore, the safest procedure is to simulate the new critical values. Table 6 presents the Trace test results with the Bartlett corrections and the simulated critical values.

[Table 6 about here]

The choice of the cointegration rank is not clearly defined, in fact the Trace test Bartlett corrected suggests that $r = 3$ is accepted only at 10% significance level. Looking at the significance of the α coefficients of the third cointegration vector in Table 7 it seems that information regarding the real GDP and the real commodity prices would be neglected by choosing $r = 2$.

[Table 7 about here]

A graphical inspection of the cointegrating relations in Figure 4 reveals some symptom of I(2)ness. The first two cointegration relationships look fairly stationary, but the third one presents some indication of cyclical swings. However, it should be observed that the

[3] An exception to this are the centered seasonal dummies, which, by construction, sum to zero over time, and hence do not change the asymptotic distribution of the rank tests.

lower panel ($\beta_r' R_{1t}$) corrected for short-run effects of each graph is similar to the upper panel ($\beta_r' x_t$), confirming that the I(2) problem could have been limited (see appendix for a formal I(2) rank test).

[Figure 4 about here]

Moreover, an examination of the characteristic roots shows that the largest unrestricted root for $r = 2$ is 0.90 and for $r = 3$ is 0.78 (pretty far from the unit circle). This seems to confirm the presence of three common stochastic trends. Figure 5 shows the roots of the companion matrix for $r = 3$.

[Figure 5 about here]

4.5. Recursive Tests

The graphs of the recursively calculated fluctuation tests in Figure 6 show that the X-form of $\hat{\tau}_1$ and $\hat{\tau}_3$ are in the rejection region at the beginning of 1995, when the recursion starts. The test statistics remain at a fairly high level until approximately 1998. The recursive graphs of the $\hat{\tau}_2$ suggest that the parameter of the second cointegration relation are considerably constant over the sample period. The overall test in the lower right-hand side panel picks up the non-constancy at the beginning of the recursions. However, it should be

noted that the R-form looks stable in all $\hat{\tau}$, meaning that the instability is only in the short-run coefficients. In general, the eigenvalue fluctuation tests provide a fair picture.

[Figure 6 about here]

The Max test of β Constancy is always lower than one and shows a slightly higher volatility after 2003. Figure 7 confirms what is suggested by the eigenvalue fluctuation tests, namely that the changes in the eigenvalues are due to changes in α.

[Table 7 about here]

4.6. Long-Run Exclusion

The Π matrix gives tentative evidence of long-run exclusion for the variables in the system. If a variable is excludable, the coefficients in the columns must be insignificant. From the PI matrix there are no clear signs that any of the variables can be excluded from the cointegration relations.

A formal LR-test for variable exclusion has been performed. Based on the results in Table 8, it is not possible to exclude any variable at 10% significance level for $r = 3$. However, the real commodity prices seem to be a border-line case.

[Table 8 about here]

4.7. Weak Exogeneity and Pure Adjustment

The The Π matrix gives preliminary evidence of weak exogeneity. If a variable is weakly exogenous, the coefficients in the rows must be insignificant; in other words, it represents a pushing force. The only variable that seems not to react to any other variables is the real money.

The formal LR-test for weak exogeneity in Table 9 shows that both real GDP and real money are weakly exogenous at 10% significance level, even though the joint exogeneity is rejected. It has been decided to carry out the analysis including them in the system in order to analyze their impact in the Γ matrix.

[Table 9 about here]

Another LR-test is carried out to test for unit vector in the α matrix. In other words, it tests whether the cumulated disturbances from the i^{th} variable do not enter the common trends (pure adjustment hypothesis). At 10% significance level Table 10 shows that the null hypothesis cannot be rejected for the long term interest rate and the real commodity prices. Thus, these can be considered pulling forces.

[Table 10 about here]

4.8. Identification and Interpretation of the Results

The identifications process starts from the long-run relationships. It is carried out by imposing $r-1$ non-testable[4] just-identifying restrictions on each beta vector of the unrestricted reduced VAR model with rank $r=3$, with no changes to the likelihood function with respect to the under identified model. Table 11 presents the estimation results that seem to suggest that the first beta vector is describing a money demand relationship with an unconventional sign on the inflation variable. The second cointegrating relationship illustrates the expected correlation between real output, real money, real commodity prices and a trend. Finally, the third stationary vector is expressing a relationship between inflation and the interest rate spread.

[Table 11 about here]

The over-identified structure is modeled imposing restrictions accordingly to the t-value of the β vectors' coefficients of the just-identified structure. This is accepted with a fairly large p-value of 0.642 (meaning that the stationarity of the long-run relations cannot be jointly rejected).

[4] Since we have imposed $r-1$ restrictions, there are zero degrees of freedom, thus restrictions cannot be tested.

Table 12 permits the detection of the pulling forces for each cointegration relation. The money demand relationship is corrected by changes in inflation, whereas the real commodity prices are the only equilibrium correcting force for the second cointegrating relation. Lastly, deviations from the inflation expectations relationship are corrected by inflation itself.

[Table 12 about here]

The short-run identification has been carried out by removing all the non-significant variables from each equation of the cointegrated VAR[5]. The parsimonious structure cannot be rejected with a p-value of 0.257 and is broadly consistent with the classification into pushing and pulling forces[6].

The equation for the interesting variable is reported in Table 13.

[Table 13 about here]

From the inspection of the Ω matrix in Table 14, it is evident that some residuals are highly correlated (positively between real GDP and real money, negatively between inflation and real GDP, negatively between inflation and real money and positively between the two interest rates) and this would suggest a simultaneous specification of the model. Nonetheless,

[5] Centered seasonal dummies have been left in the equations for each variable, even if insignificant.

[6] The equilibrium correcting role of the real commodity prices for the second cointegrating relationship confirmed.

such analysis has not been pursued because of the problems in determining the direction of the causation between the mentioned variables.

[Table 14 about here]

Overall, the results confirm the existence of the hypothesized long-run equilibrium relationship between real money and real commodity prices, with an effect from real output. Moreover, there is evidence that the real commodity prices are the only equilibrium correcting variable.

It can be concluded that in order to restore the long-run equilibrium when there is a real excess (lack) of liquidity, the real commodity prices need to increase (decrease). Such increase (decrease) can be achieved through an increase (decrease) in the commodity prices stronger (smaller) than the increase (decrease) in the consumer goods' prices, generating a larger spread between the two as in Figure 8.

[Figure 8 about here]

The Moving Average (MA) representation of the data for $r = 3$ corresponds to $p - r = 3$ common trends. Since $p - r - 1 = 2$ just-identifying restrictions are imposed on each vector, estimates are not unique and the likelihood function is unchanged. However, the space spanned by $\alpha_{\perp}$ and $\beta_{\perp}$ is uniquely determined, so that the estimated long-run impact

matrix C is unique[7]. The normalization has been placed on the variables with the highest residual standard errors, namely real GDP, real money and real commodity prices.

The cumulated empirical shocks to the real GDP have had significant and high negative effects on the real commodity prices. The inverse is true, but the impact is much more moderate. The cumulated shocks to real money have had positive effects on inflation, as well as the cumulated shocks to short-term interest rate on long-term term one and vice versa. Moreover, the cumulated shocks to long term interest rate have had positive effects on inflation. Likewise, the cumulated shocks to inflation have had similar positive effects on both the interest rates. Finally, the cumulated shocks to all the variables have had a positive effect on themselves. It seems that the long-term interest rate is purely adjusting (consistently to the previous findings).

In order to impose the over-identifying restrictions on α, joint weak exogeneity for real money and real GDP is tested keeping fixed the restrictions on the β vectors. Since the hypothesis turns out to be rejected at 10% significance level, a zero row in α is imposed only for the real money, for which the null hypothesis cannot be rejected with a p-value of 0.505. The C matrix of the over-identified MA representation is broadly consistent with the results obtained for the just-identified structure.

As a robustness check, the CRB has been replaced with the Conference Board's Sensitive Materials Index (SENSI). This comprises raw materials and metals but excludes food and energy. The results remain broadly the same as before.

[7] As when imposing just-identifying restrictions on the cointegrating relationships, the PI matrix was uniquely determined, albeit α and β vectors were not.

5. Conclusions

Commodity prices are currently seen as one or the main source of current inflationary pressures and there seems to exist, as discussed by Frenkel (2006), a linkage between increases in commodity prices in commodity exporting countries and monetary policy changes in advanced industrial economies. This, as suggested, would defy the common knowledge that changes in commodity prices are solely impacted by developments occurring in the commodity markets.

The aim of the paper is to identify the nexus between the excess of liquidity in the US and commodity prices over the period 1983-2006 within a cointegrated VAR framework and in particular at testing whether the commodity prices react more powerfully than the consumer goods' prices to changes in real money balances.

The results provide empirical evidence on the magnitude of the reaction of commodity and consumer goods' prices to an increase in real money. In particular, a long-run equilibrium relationship between real money and real commodity prices has been found, with an effect from real output. The two variables of interest show positive and significant correlation.

Moreover, real money seems to be a weakly exogenous variable and therefore is a pushing force (away from the equilibrium), whereas real commodity prices are the only equilibrium correcting variable to such cointegration relationship, or pulling force.

Therefore, in order to restore the long-run equilibrium when there is a real excess (lack) of liquidity, the real commodity prices need to increase (decrease). Such increase (decrease) can be achieved through an increase (decrease) in the commodity prices stronger (smaller) than the increase (decrease) in the consumer goods' prices, generating a larger spread between the two.

The results have important policy implications. More specifically, if the magnitude of the reaction is due to the fact that consumer goods' prices are slower to react, then their long-run value can be predicted with the help of the commodity prices. In other words, the extent of the rise in the commodity prices acts to predict subsequent changes in the price of the other goods, namely the consumer goods, whose price is initially unchanged.

Moreover, the results also support the idea that monetary policy cannot only focus on the core CPI and ignore developments in the commodity market. In fact, if commodity prices are very high it might be the case that monetary policy is loose; therefore they should be taken into account as a useful monetary indicator. This conclusion is particularly relevant to those countries that are adopting an inflation targeting regime which target is the CPI.

Appendix

The rank test for the I(2) system has been performed for the system of variables (X_t) used in the analysis. The result is border-line as the hypothesis H(3,2,1) cannot be rejected with a p-value of 0.105. Therefore, the system might present rank equal to three, two I(1) trends and one I(2) trends.

However, it should be noted that the estimates obtained are consistent even when there are I(2) trends and that the standard tests (except the I(1) trace test) are still valid.

Table A: I(2) Rank Test

p-r	r	s2 = p-r-s1 6	5	4	3	2	1	0
6	0	585.487	430.095	349.873	283.396	241.097	209.188	190.965
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
5	1		340.790	270.370	207.163	167.098	134.455	116.182
			(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
4	2			207.162	152.244	108.296	81.881	67.516
				(0.000)	(0.000)	(0.003)	(0.018)	(0.022)
3	3				102.274	66.687	47.417	38.974
					(0.003)	(0.084)	(0.105)	(0.117)
2	4					40.874	26.709	16.859
						(0.239)	(0.316)	(0.434)
1	5						12.445	3.334
							(0.424)	(0.827)
Approximate 95% Fractiles								
6	0	282.595	244.789	211.074	181.464	155.978	134.640	117.451
5	1		206.055	174.292	146.636	123.112	103.747	88.554
4	2			141.531	115.818	94.243	76.841	63.659
3	3				89.020	69.376	53.921	42.770
2	4					48.520	34.984	25.731
1	5						20.018	12.448

Notes: p-values in brackets. The critical values correspond to the “Basic Model”.

Table 1: Descriptive statistics of the variables

Variable	Obs	Mean	SD	Min	Max
Real Money (M2)	157	7.86	0.72	6.38	9.02
Real GDP	157	24.47	0.27	23.98	24.91
T-Bill Rate	157	5.79	2.92	0.23	15.09
Govt Bond Yield	157	7.38	2.56	2.73	14.85
CPI Inflation	157	4.72	0.51	3.66	5.41
Real Commodity Prices	157	-0.19	0.39	-0.83	0.60

Source: IFS, CRB.

Table 2: Unit Root Tests

Variables	ADF test		KPSS test	
	Level	Difference	Level	Difference
Real Money (M2)	-1.43	-4.80**	1.59**	0.25
Real GDP	-2.98	-4.93**	1.98**	0.28
T-Bill Rate	-3.07	-3.64*	1.25**	0.09
Govt Bond Yield	-3.33	-5.32**	1.70**	0.05
CPI Inflation	-1.57	-3.83*	1.98**	0.45
Real Commodity Prices	-2.73	-6.15**	1.43**	0.17

Notes: The augmented Dickey-Fuller (ADF) test statistics are from a model that includes as many lags as suggested by and the Akaike Information Criterion (AIK) Hannan-Quinn (HQ) criterion, a constant and a trend.

Table 3: Lag Length Determination

Model	k	T	Regr	Log-Lik	SC	H-Q	LM(1)	LM(k)
VAR(5)	5	90	38	3282.75	-61.55	-65.33	0.595	0.856
VAR(4)	4	90	32	3244.50	-62.50	-65.68	0.815	0.016
VAR(3)	3	90	26	3208.81	-63.51	-66.09	0.239	0.139
VAR(2)	2	90	20	3172.93	-64.51	-66.50	0.088	0.731
VAR(1)	1	90	14	3105.83	-64.82	-66.21	0.000	0.000

Notes: k are the lags in the model, T is the number of observations.

Table 4: Multivariate Residual Analysis

Autocorrelation LM(1) LM(2)	Normality	ARCH LM(1) LM(2)
$X^2(36)$ = 46.019 [0.122] [0.668]	$X^2(12)$= 9.509 [0.659]	$X^2(441)$ = 427.608
$X^2(36)$ = 37.473 [0.401] [0.173]		$X^2(882)$ = 921.552

Notes: p-values in brackets.

Table 5: Univariate Residual Analysis

Variable	ARCH(2)	Normality	Skewness	Kurtosis
Δ Real Money (M2)	4.717 [0.095]	1.430 [0.489]	0.264	2.736
Δ Real GDP	3.279 [0.194]	4.262 [0.119]	-0.390	3.733
Δ T-Bill Rate	5.583 [0.061]	1.856 [0.395]	-0.215	3.325
Δ Govt Bond Yield	0.787 [0.675]	0.506 [0.777]	0.169	2.868
Δ CPI Inflation	4.800 [0.091]	2.085 [0.352]	0.016	3.411
Δ Real Commodity Prices	1.768 [0.413]	0.458 [0.795]	-0.010	3.050

Notes: p-values in brackets.

Table 6: Trace Test Statistics

$p-r$	r	Eig.Value	Trace	Trace*	Frac95	P-Value	P-Value*
6	0	0.553	190.965	164.447	115.237	0.000	0.000
5	1	0.407	116.182	101.056	85.895	0.000	0.002
4	2	0.264	67.516	59.345	62.538	0.016	0.088
3	3	0.212	38.974	33.960	41.737	0.097	0.254
2	4	0.135	16.859	15.222	25.295	0.406	0.533
1	5	0.035	3.334	2.988	12.486	0.811	0.852

Notes: Bartlett correction of the rank test is denoted by *.

Table 7: α and β vectors for $r = 3$

Vector	Real GDP	Real M2	T-Bill	Govt Yield	CPI Infl	Real Comm P	Trend
$\hat{\beta}_1'$	6.744	1.000	0.173	0.638	-202.583	0.879	-0.034
$\hat{\beta}_2'$	-3.564	1.000	0.231	-0.237	-8.757	-0.187	0.014
$\hat{\beta}_3'$	-0.310	0.055	-0.101	0.064	1.000	-0.033	0.001

Variables	α_1	α_3	α_3
Real GDP	-0.003	0.008	0.046
	(-1.655)	(0.745)	(2.341)
Real M2	-0.002	-0.019	-0.032
	(-1.223)	(-1.520)	(-1.468)
T-Bill	-0.025	-0.433	0.483
	(-1.049)	(-2.693)	(1.732)
Govt Yield	-0.080	0.577	-0.152
	(-2.677)	(2.809)	(-0.426)
CPI Infl	0.006	0.016	-0.005
	(6.949)	(2.742)	(-0.505)
Real Comm P	-0.016	0.106	0.621
	(-1.274)	(1.220)	(4.118)

Notes: t-values in brackets.

Table 8: Long-Run Exclusion

R	DGF	5% C.V.	Real GDP	Real M2	T-Bill	Govt Yield	CPI Infl	Real Comm P	Trend
1	1	3.841	1.870	0.464	0.263	2.954	24.229	2.828	2.429
			[0.171]	[0.496]	[0.608]	[0.086]	[0.000]	[0.093]	[0.119]
2	2	5.991	21.386	17.682	13.021	17.659	44.240	6.294	21.047
			[0.000]	[0.000]	[0.001]	[0.000]	[0.000]	[0.043]	[0.000]
3	3	7.815	26.999	17.964	18.735	22.146	50.640	6.388	22.339
			[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.094]	[0.000]
4	4	9.488	29.597	25.850	27.146	23.835	59.199	13.365	22.341
			[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.010]	[0.000]
5	5	11.070	38.923	30.867	37.155	33.683	68.021	20.884	30.340
			[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.001]	[0.000]

Notes: p-values in brackets.

Table 9: Test for Weak Exogeneity

R	DGF	5% C.V.	Real GDP	Real M2	T-Bill	Govt Yield	CPI Infl	Real Comm P
1	1	3.841	2.071	1.213	0.710	4.539	19.275	0.998
			[0.150]	[0.271]	[0.400]	[0.033]	[0.000]	[0.318]
2	2	5.991	2.442	3.112	5.357	11.204	35.321	1.709
			[0.295]	[0.211]	[0.069]	[0.004]	[0.000]	[0.425]
3	3	7.815	4.538	4.884	6.952	11.345	36.193	6.640
			[0.209]	[0.181]	[0.073]	[0.010]	[0.000]	[0.084]
4	4	9.488	10.855	4.988	9.042	12.632	36.895	12.794
			[0.028]	[0.289]	[0.060]	[0.013]	[0.000]	[0.012]
5	5	11.070	14.584	7.949	18.947	20.752	46.093	20.846
			[0.012]	[0.159]	[0.002]	[0.001]	[0.000]	[0.001]

Notes: p-values in brackets.

Table 10: Test for Pure Adjustment

R	DGF	5% C.V.	Real GDP	Real M2	T-Bill	Govt Yield	CPI Infl	Real Comm P
1	5	11.070	44.672	53.863	33.205	27.097	7.898	49.811
			[0.000]	[0.000]	[0.000]	[0.000]	[0.162]	[0.000]
2	4	9.488	23.456	31.534	8.286	11.106	7.337	24.816
			[0.000]	[0.000]	[0.082]	[0.025]	[0.119]	[0.000]
3	3	7.815	6.450	17.230	7.770	4.286	7.311	5.124
			[0.092]	[0.001]	[0.051]	[0.232]	[0.063]	[0.163]
4	2	5.991	1.927	13.706	4.685	4.136	6.926	1.227
			[0.382]	[0.001]	[0.096]	[0.126]	[0.031]	[0.541]
5	1	3.841	0.421	10.151	0.318	0.541	4.807	1.064
			[0.517]	[0.001]	[0.573]	[0.462]	[0.028]	[0.302]

Notes: p-values in brackets.

Table 11: The just-identified long-run cointegration relations for $r = 3$ and the α coefficients.

Vector	Real GDP	Real M2	T-Bill	Govt Yield	CPI Infl	Real Comm P	Trend
$\hat{\beta}_1'$	-0.979	1	-0.598	0.598	-62.152	0	-0.001
	(-1.796)		(-6.575)	(6.575)	(-11.789)		(-0.171)
$\hat{\beta}_2'$	-4.148	1	-0.145	0	0	-0.285	0.016
	(-10.745)		(-4.319)			(-4.279)	(6.391)
$\hat{\beta}_3'$	0	0	0.170	-0.129	1	0.017	0.001
			(9.357)	(-6.876)		(0.870)	(1.686)

Variables	α_1	α_3	α_3
Real GDP	-0.009	0.017	-0.036
	(-1.488)	(1.691)	(-0.949)
Real M2	-0.010	-0.013	-0.056
	(-1.543)	(-1.123)	(-1.355)
T-Bill	-0.177	-0.003	-0.017
	(-2.055)	(-1.756)	(-3.258)
Govt Yield	-0.165	0.007	0.008
	(-1.500)	(3.533)	(1.127)
CPI Infl	0.023	-0.002	0.111
	(7.484)	(-0.335)	(5.756)
Real Comm P	-0.052	0.176	-0.275
	(-1.118)	(2.248)	(-0.952)

Notes: t-values in brackets.

Table 12: The over-identified long-run cointegration relations for $r = 3$ and the α coefficients.

Vector	Real GDP	Real M2	T-Bill	Govt Yield	CPI Infl	Real Comm P	Trend
$\hat{\beta}_1'$	-1	1	4.045	-3.832	46.431	0	0
			(9.401)	(-8.880)	(10.579)		
$\hat{\beta}_2'$	-4.073	1	0	0	0	-0.338	0.018
	(-11.655)					(-6.603)	(8.278)
$\hat{\beta}_3'$	0	0	0.039	-0.039	1	0	-0.000
			(9.041)	(-9.041)			(-2.998)

Variables	α_1	α_3	α_3
Real GDP	-0.012	0.018	1.114
	(-1.753)	(1.615)	(1.699)
Real M2	-0.011	-0.010	1.078
	(-1.459)	(-0.808)	(1.489)
T-Bill	-0.242	-0.365	20.742
	(-2.580)	(-2.341)	(2.265)
Govt Yield	-0.153	0.535	19.056
	(-1.241)	(2.606)	(1.577)
CPI Infl	0.025	-0.004	-2.505
	(7.439)	(-0.746)	(-7.494)
Real Comm P	-0.062	0.208	5.581
	(-1.187)	(2.392)	(1.093)

Notes: t-values in brackets.

Table 13: Short-run Identification, equation for the real commodity prices

Independent Variable	Coefficient	Std.Error	t-value	t-prob
Second Coint Rel	0.166	0.060	2.75	0.007
Constant	15.784	5.738	2.75	0.007
CSeasonal	-0.006	0.013	-0.434	0.666
CSeasonal_1	-0.004	0.013	-0.322	0.748
CSeasonal_2	-0.009	0.013	-0.656	0.514

Table 14: Correlation of Structural Residuals (standard deviations on diagonal)

−	Real GDP	$Real\ M2$	$T-Bill$	Govt Yield	CPI Infl	Real Comm P
Real GDP	0.006	−	−	−	−	−
$Real\ M2$	0.463	0.006	−	−	−	−
$T-Bill$	0.209	−0.350	0.001	−	−	−
Govt Yield	0.290	−0.149	0.664	0.001	−	−
CPI Infl	−0.443	−0.601	0.219	0.318	0.003	−
Real Comm P	0.226	−0.127	0.420	0.374	0.193	0.045

Figure 1: Short and long-run impact of a liquidity shock to price elastic and price inelastic good.

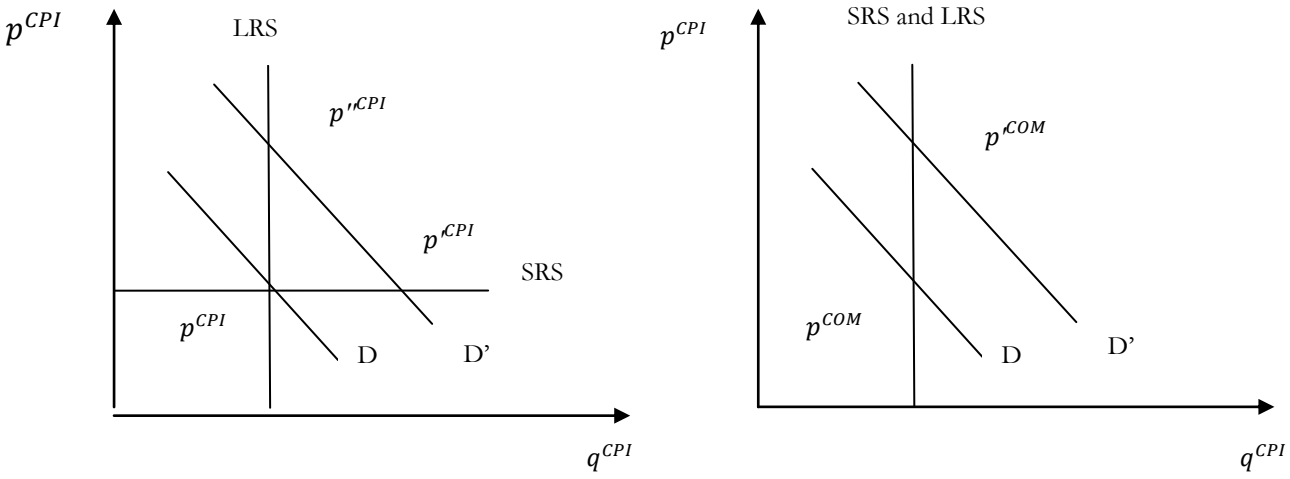


Figure 2: Data in levels

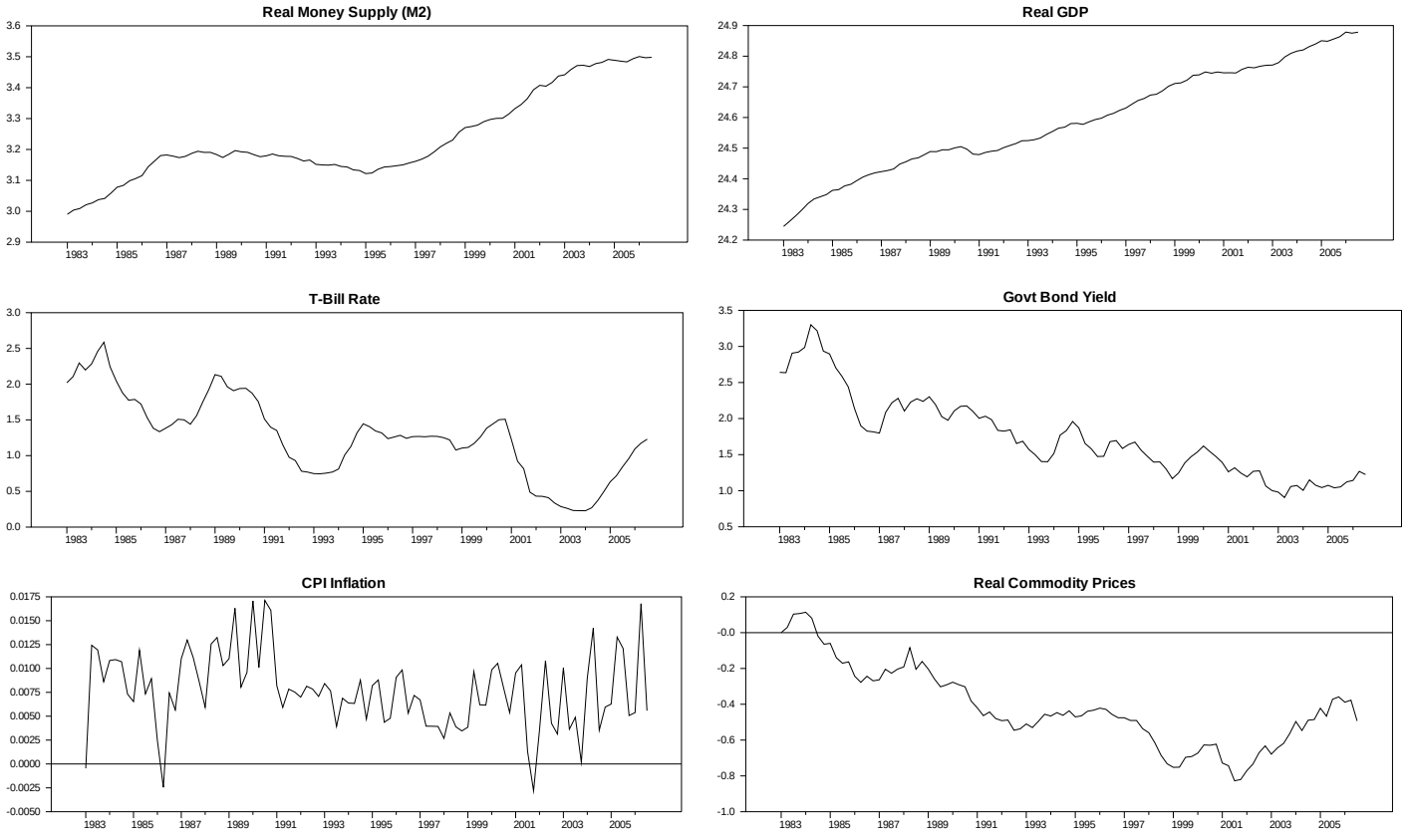
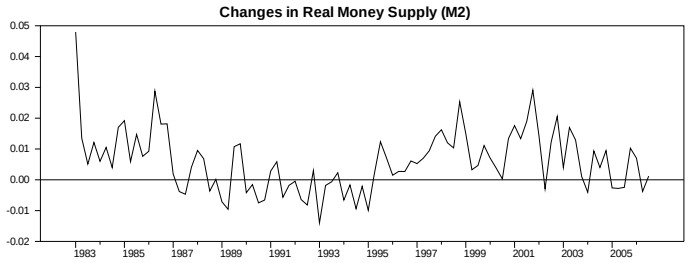
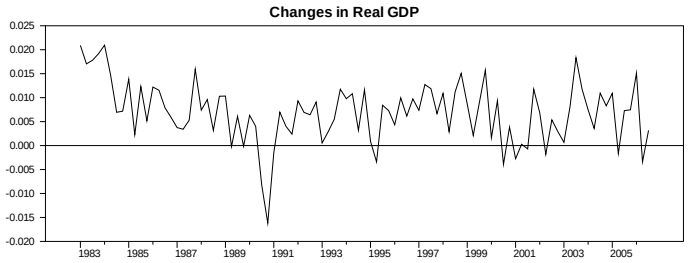
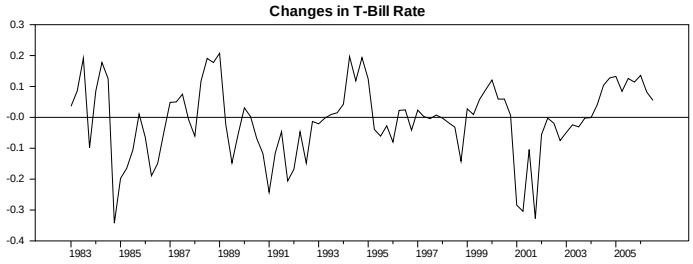
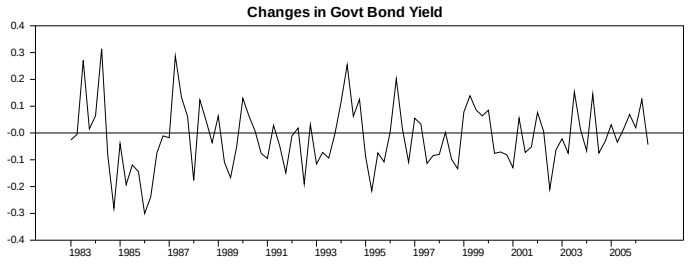


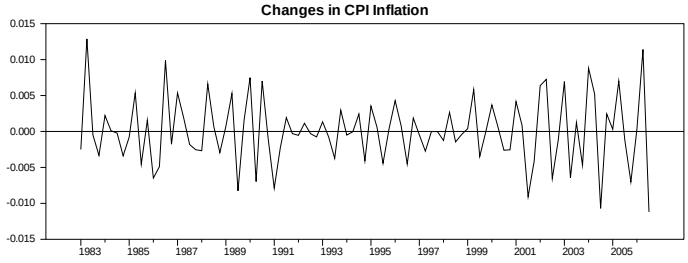
Figure 3: Data in first differences











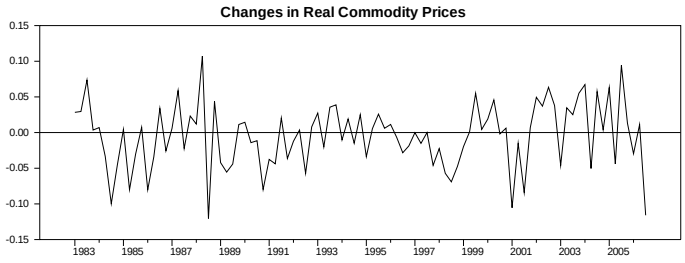


Figure 4: Cointegrating relationships

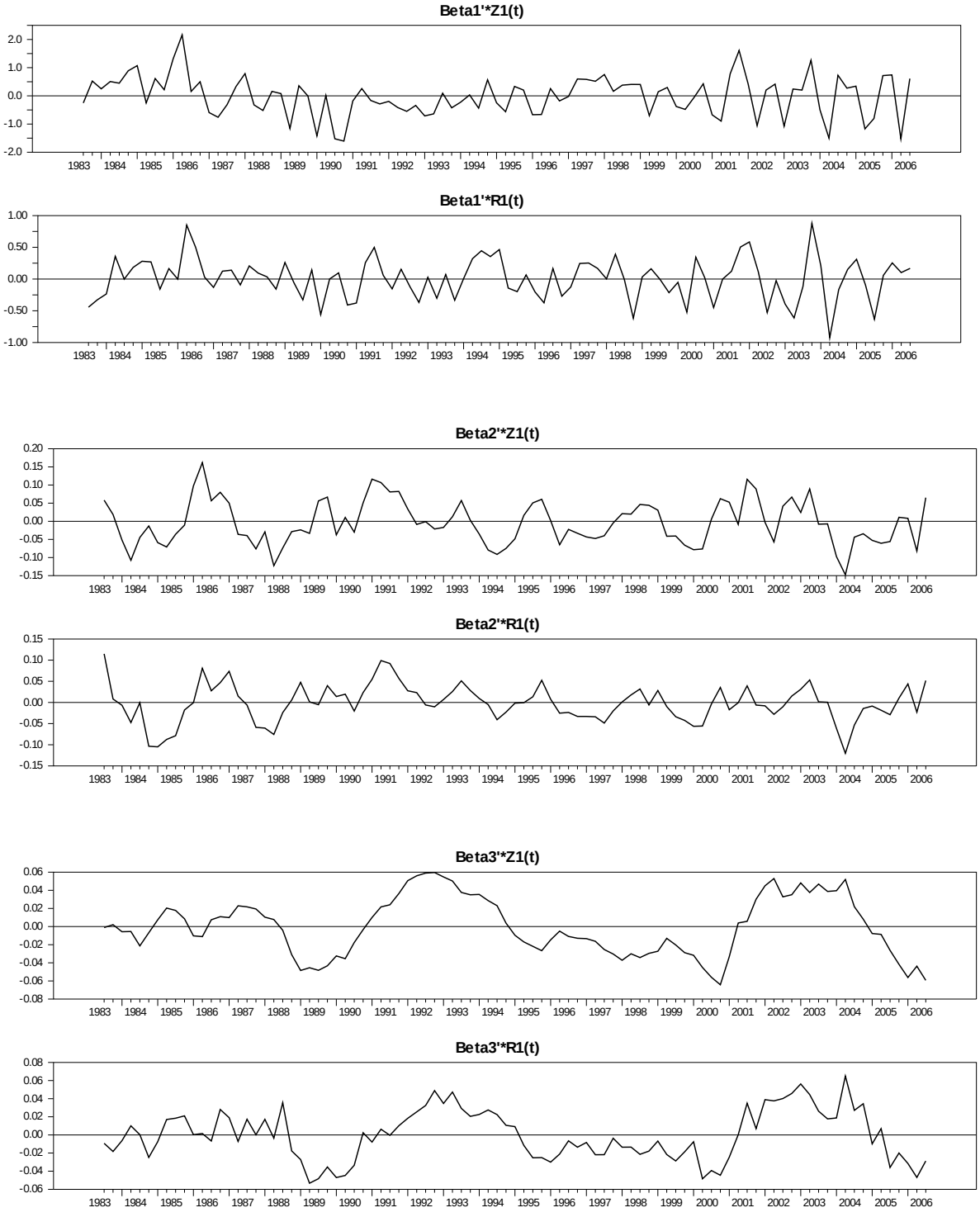


Figure5: Roots of the Companion Matrix for $r = 3$

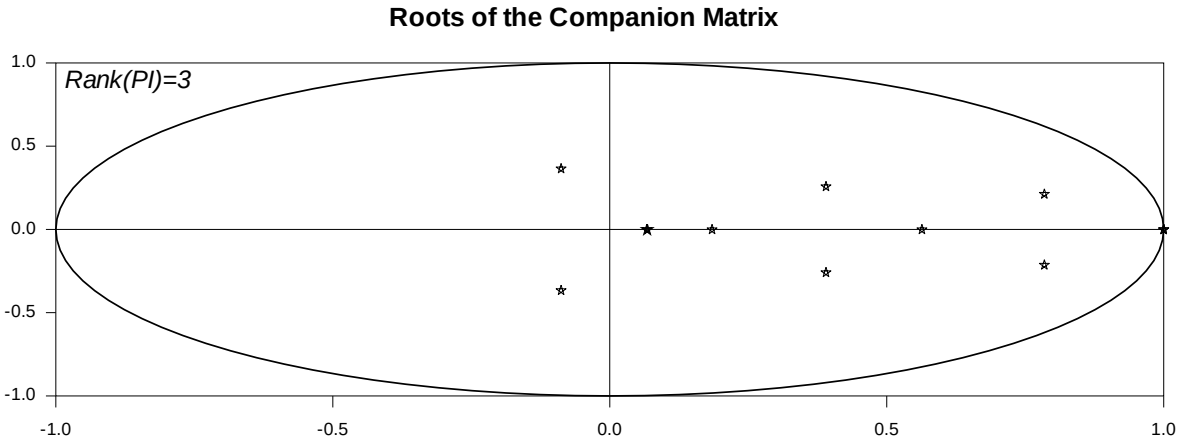


Figure 6: Eigenvalue Fluctuation Test for $r = 3$

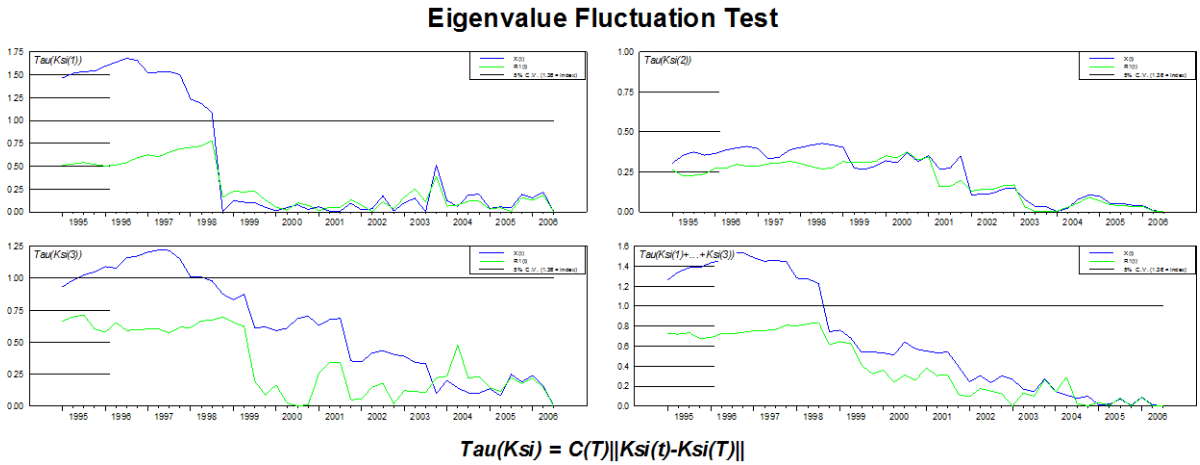


Figure 7: Max Test of Constant β

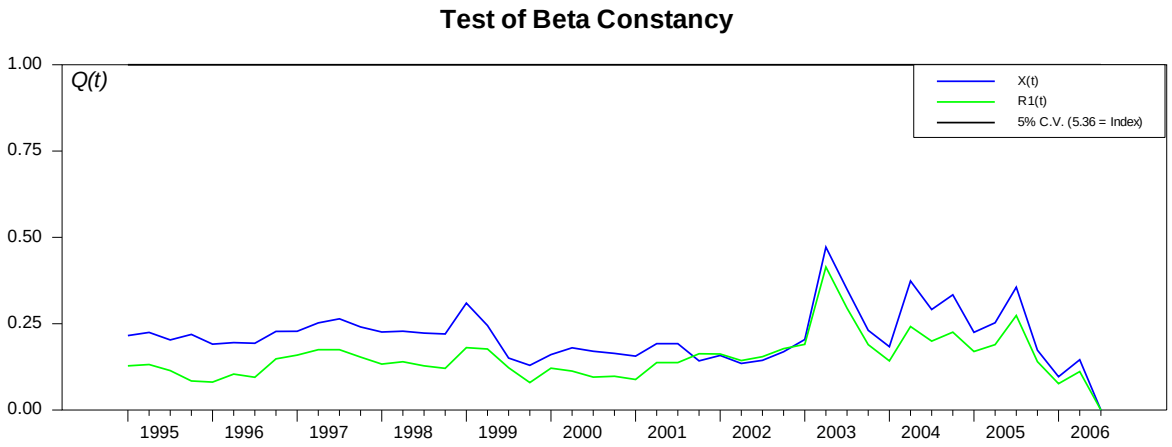
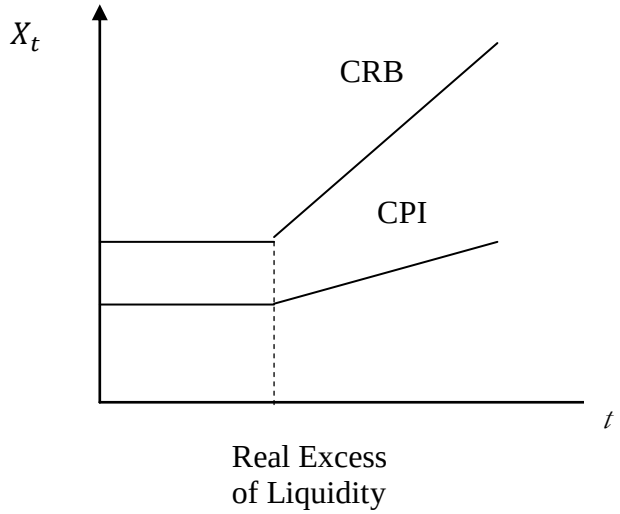


Figure 8: Commodity Prices and Consumer Goods´ prices reactions to Real Excess of Liquidity



Chapter 4: Determinants and Dynamics of Schooling and Child Labor in Bolivia

Abstract

This paper investigates the determinants of primary school enrollment, attendance and child labor in Bolivia from 1999 to 2007. The analysis also aims at identifying the substitution and complementary relationships between schooling and working. Although enrollment rates show a significant improvement, lack of attendance remains an issue. The empirical results reveal that the increase in enrollment is led by indigenous children and those living in urban areas. Moreover, contrary to common belief, being extremely poor and indigenous are the main determinants of school attendance. Although extremely poor children increased their school attendance, they were not able to reduce child labor. However, for indigenous children school attendance and child labor were substitutes, increasing schooling and reducing child labor.[1]

[1] The author wishes to thank Soren Anderson, Fabrizio Carlevaro, Richard G. Newell and Marc-Alexandre Sénégas for the kind support in carrying out the econometric analysis. A special thank to Simona Iammarino, Dena Ringold, Robert Vos and to the ILAS at Columbia University for providing us with important comments. Note that all mistakes and opinions expressed in the paper belong to the authors only.

1. Introduction

Bolivia remains among the three poorest countries in the western hemisphere and the poorest in South America (UNDP, 2007), with a per capita GDP of 1378 US dollars and with 37.7 percent of the population living below the extreme poverty line in 2007[2]. According to the United Nations, achieving primary education represents a key factor for enhancing development progresses in the poorest countries[3]. Efforts have been made to guarantee the continuous provision of universal, free-of-charge primary education. However, the fact that Bolivia has an illiteracy rate of 13 percent for people aged 15 or older confirms that the difficulties experienced by its educational system are among the most severe in Latin America (World Bank, 2008).

In order to reaffirm the commitment of the state to improve the educational system, a series of cash-transfer benefits and school feeding programs have been approved over the last 20 years. These programs are believed to be effectively contributing to higher enrollment and attendance rates, nevertheless several challenges concerning lack of homogenous implementation across municipalities and schools still need to be overcome. Likewise, with the goal of creating enabling conditions to guarantee the effective, multiethnic and non-discriminatory access to educational services, special programs such as the Intercultural Bilingual Educational Program have been developed to attend the needs of the vast indigenous population of the country[4].

[2] GDP data are from the United Nations National Accounts Main Aggregate Database, data on poverty are from MECOVI 2007.

[3] More specifically, this represents the second Millennium Development Goal (MDG) as established by the United Nations.

[4] According to the MECOVI surveys employed, more than 50 percent of the total Bolivian population declare themselves belonging to indigenous groups.

Moreover, Bolivia represents a country with a high share of child labor. This share achieves about 30 percent among extremely poor families. Child labor not only represents an exploitative activity, but it is also associated with a low level of education (see Basu and Van, 1998 for example), therefore jeopardizing human capital growth. Yet, as emphasized by Baland and Robinson (2000), the real issue is to better understand the determinants of child labor so as to evaluate its welfare implications. More generally, it is crucial to jointly investigate the factors driving schooling and child labor decisions.

This paper aims at analyzing the determinants of primary school enrollment, attendance and child labor in Bolivia from 1999 to 2007, identifying how the substitution and complementary relationships among such activities evolve over time.

The unprecedented use of Bolivia's national household survey MECOVI for several years allows for an in-depth historical analysis of the recent trends of schooling and child labor. Due to the lack of empirical literature on this specific issue for Bolivia, this study represents a contribution that aims at filling the gap.

Results at the descriptive level reveal that enrollment became progressively more widespread in Bolivia. Nonetheless, the attendance figures are discouraging, as about 40 percent of the enrolled children did not go to school.

Triprobit estimations show that the increase in enrollment is led by indigenous and children living in urban areas, whereas poverty and indigenous are the main characteristics driving the attendance behavior. While school feeding and conditional cash transfer programs are likely to have allowed extremely poor children to attend school, at the same time these do not seem sufficient to let them forgo child labor. In fact, the proportion of working children seems not to be affected by school incentives since extremely poor children manage to allocate their time between school and working activities (presumably reducing their leisure

time), making those complements. On the contrary, indigenous children made them substitutes, increasing schooling and decreasing working.

Furthermore, the empirical evidence also shows that the implementation of the *Bono Juancito Pinto* (BJP) scholarship in 2006 has a negative effect on attendance in 2007 as possibly children tend to enroll to benefit from the first installment but they do not attend school afterwards. In addition, the BJP does not discourage children abandoning working activities.

The paper structure is as follows. Section 2 introduces the socio-political Bolivian context and briefly reviews the education system reforms. Section 3 goes through some of the main contributions in the empirical literature. The theoretical framework used for the analysis is presented in Section 4. The empirical strategy and the model are described in Section 5. In Section 6, the descriptive statistics and the empirical findings are presented. Section 7 reports the conclusions.

2. The education system in Bolivia: a Historical Perspective

This section introduces a brief summary of the main education policies adopted in Bolivia, along with a short review of the main socio-political events of the last two decades.

Reforms of the education system in Bolivia have been undertaken since 1905, when the first reform established a national education system. In 1955, the second important reform increased education coverage and supported a homogenous national culture. The 1970s and the 1980s were marked by a variety of education interventions which lacked central coordination or long-term plans.

During the 1980s, Bolivia started a long transition into democracy. In 1993 a coalition in the Congress selected Sánchez de Lozada of the Revolutionary Nationalist Movement

(MNR) as president, who pursued an aggressive economic and social reform agenda. The most dramatic change was the capitalization program that leaded to the sale of many national enterprises. This process was accompanied by frequent social protests.

On the educational front, the current Education Reform Program (ERP) is considered the third important reform of the Bolivian education system. The Ministry of Planning established the Technical Support Team of the Education Reform (ETARE), and the Education Reform Law was successfully introduced in 1994. The Educational Reform Law stipulates that the Bolivian State has the duty to offer free-of-charge education to all citizens, which is equivalent to a sub-guarantee of financial protection of the preprimary, primary and secondary education. As a matter of fact, however, educational spending focuses on primary education due to the national priority of guarantying access to this level.

The reform aimed at improving the quality and efficiency of education, making it more relevant to the country's economic needs, broadening its coverage, promoting the permanence of educators in the system, and addressing the needs of the vast indigenous population of the country[5]. Toward these ends, it restructured the education system and its administration, extended the years of mandatory education from five to eight, improved the teacher training system, and prioritized primary education incorporating the Intercultural Bilingual Educational Program[6]. Although a conclusive evaluation is not available, data suggests that there have been substantial improvements at the national level. Despite this,

[5] Many of the programs of the Educational Reform have introduced a set of guarantees that can be subject to redress by indigenous people if their right to access educational services in accordance to their languages and cultural characteristics is not granted by the State.

[6] Education may be monolingual in Spanish with the additional study of an indigenous language or it may be bilingual with an indigenous language as the first language and Spanish as the second language.

Bonifaz and Ochoa (2002) highlight some deficiencies across municipalities, income groups and ethnic groups that jeopardize the achievement of the universal primary education.

There have been other initiatives such as the *Programa de Atencion a Niños y Niñas Menores de 7 Años* (PAN), which was created in April of 1997 by the Bolivian government within the 1997-2001 Country Programme of the World Food Programme (WFP) with the goal of achieving adequate development and growth of children under the age of six. It reaches 72,000 children that are in a situation of extreme poverty, and provides them with education, nutrition, healthcare and protection. The children who attend these day care centers are fed breakfast and lunch and receive general care during the day while their mothers are in class. The Day Care Center has more than 450 centers in the province of Chuquisaca, and serves 8,500 children. Unfortunately the budget that the centers receive from the state is insufficient and does not cover the basic needs. Furthermore, there are no funds available for the maintenance of the infrastructure of the centers, and as a result, the centers are in an abandoned state and in bad need of repairs and renovations.

In 2004, the Street Children Programme was introduced with the aim to contribute to the development of 7,200 boys, girls and adolescents who live and work on the street through greater access to integrated educational services, health and nutrition within a framework of gender equality. The mechanism is food for training.

During the new election held in December 2005, Evo Morales was elected as the first indigenous president with a large victory reaching 54 percent of the electorate's votes. President Evo Morales introduced a 50 percent increase of the minimum wage in March 2006, and two months later nationalized most of Bolivia's natural gas fields, which many indigenous Bolivians had been demanding for years.

Among the main policies adopted by Morales, the BJP became law in 2006. These scholarships benefited approximately 1.2 million public school students, from roughly 13,000

schools across the nation. Over half of the children targeted by the law (those between the ages of five and ten years old) have never attended or do not currently attend school. The money is distributed in cash directly to the children in nationwide ceremonies conducted with the help of the armed forces. It is paid in installments of 100 *Bolivianos*, one at the beginning and one at the end of the school year (nearly 26.5 US dollars a year). All public school children who are in the designated grade levels are eligible, regardless of their family's income. This bonus should encourage the children to enroll and remain at school during their required term. However, after being enrolled and therefore receiving the first payment, students are not coerced to attend school. At the same time, if they do not attend, they prevent themselves from being awarded the second trench. The BJP can be considered only one of the several policies in favor of the indigenous communities. Many others followed the new constitution, adopted in February 2009, which gave Bolivians of indigenous descent more economic and political rights.

Today, several school feeding programs are implemented in some communities in Bolivia[7]. These kinds of programs are believed to be effectively contributing to higher enrollment and attendance rates, and are sometimes combined with cash transfer programs conditional upon households letting the children go to school. An example is the In-School Breakfast Program (*Desayuno Escolar*), which started to be delivered in 1990. Many children walk at least one mile to get to school, and receiving a breakfast before starting classes alleviates their short-term hunger and lets them benefit more from the lesson. Clearly, it was conceived as a supplementary meal, meaning that the parents are supposed to provide the children with a first breakfast. However, it is not usually the case.

[7] The Ministry of Culture and Education (MEC) declared that the primary targets of such program are the children from rural areas. However, during the first years the implementation has been very inhomogeneous.

Another example is the *Programa de Alimentación Escolar* (PAE) introduced during the 2003-3007 Country Programme of the WFP, from which 42,000 children over the age of six are benefitting. The aim is to support regular primary school attendance and to improve learning capacity by means of hunger relief in the short term. The main beneficiaries are the vulnerable municipalities and the regulating body is the Ministry of Education.

Overall, Bolivia went through many liberal and nationalist cycles that substantially failed in the refunding of the State. The country is currently living a period of political, social and economic change where Evo Morales' presidency represents a symbolic revolution in giving relevance to the role of the indigenous people in the society.

3. Determinants of School Enrollment, Attendance and Child Labor: Literature Review

Education constitutes the main means through which a country invests in human capital. Therefore education may be seen as the key factor for enhancing development progresses in poorer countries. Many developing countries still experience low levels of education attainment, and this is one of the reasons why they unsurprisingly lag far behind the developed world. Thus, it became relevant to investigate the main determinants of enrollment and attendance behavior for these countries, in order to assist policymakers in designing policies that lead to increased educational attainment.

The literature on the determinants of education is vast and to review it completely would be beyond the scope of this paper. Nonetheless, before moving to the empirical analysis it is worth reviewing some of the main contributions on the determinants of households' demand for schooling and child labor.

Low levels of education in developing countries might be related to high levels of child labor as discussed in Basu and Van (1998). In this paper, which constitutes a pillar in

the economic literature on child labor, the authors clarify the positive relationship between poverty and child labor and therefore the negative effect of poverty on children's education. They claim that education, as well as leisure, is a "luxury good" for poor families with an extremely low income[8]. In their altruistic model, household wealth is the most important factor in the decision to send children to school or to work. That is, child labor arises only if adult wages are insufficient to sustain the household. Therefore, they argue that a ban on child labor may even be welfare reducing for a poor household if poverty is the main cause of child labor.

On the contrary, Baland and Robinson (2000) find that a small ban on child labor may constitute an actual Pareto improvement even though it does not directly compensate parents. The reason is that endogenous changes in wages induced by a reduction in child labor may make parents and firms better off.

The empirical investigation carried out by Jayachandran (2002) for India supports the theoretical results of Basu and Van (1998). He shows that poverty is among the key factors that explain why parents cannot afford to send their children to school. Along the same line, the empirical analysis of Psacharopoulos (1997) also confirms that child labor reduces educational attainment in Bolivia and Venezuela[9]. For the African context, Canagarajah and Coulombe (1997) find a significant negative relationship between going to school and working in Ghana.

[8] Such concept is called "luxury assumption" or "luxury axiom".

[9] Note that Psacharopoulos (1997) does not focus on the determinants of school enrolment and attendance in Bolivia. More specifically, the author does not analyze whether or not a working child is less likely to be enrolled or attend school.

In contrast, Ravallion and Wodon (2000) question that child labor displaces schooling in Bangladesh. In addition, Ray (2000) and Bhalotra (2007) do not find empirical evidence of the "luxury axiom" in the context of Pakistan and India respectively[10].

It is not easy to identify standard key determinants of education due to the country-specific socio-cultural characteristics. Schultz (1999) attempts to identify three key socioeconomic determinants of households' demand for schooling and comes up with public expenditure on education, parental education and the wealth of families.

Spending in public education in developing countries (where the level of public infrastructure is typically low) may have a huge impact on stimulating education enrollment and attendance. Duflo (2001), for example, focuses on the case of Indonesia, where a massive school construction program, implemented by the national government during the 1970s, led to a strong increase of the enrollment rate. Also Handa (2002) and Handa and Simler (2005) point out that building more schools in the context of Mozambique had a strong impact on school enrollment.

On the other hand, the lack of government support in fostering education might have drastic effects on education. In fact, Glewwe and Ilias (1996) noted that enrollment rates declined in Ghana during the late 1970s and early 1980s due to a reduction of public spending in education. Nevertheless, Al-Samarrai (2006), investigates the link between educational access and public education expenditure in a cross-country framework and finds that it is weak.

Household characteristics, such as the education of parents, probably represent one of the most relevant factors leading to children enrollment and attendance in the developing world. The idea underlying such claim is that educated parents by and large understand the

[10] See Basu (1999) for an analytical survey.

importance of achieving basic education and therefore feel responsible to send their kids to school. The reverse is true for non-educated parents who started to work at an early age. This is evident in Wahba (2006) that shows that Egyptian parents, who were child laborers themselves, would most likely send their children to work. In other words, for those parents education may not necessarily be considered as an investment.

Some studies also consider cultural aspects such as gender issues that may influence some disparities in enrollment and attendance. Tansel (2000) points to gender as one characteristic that should not be neglected when analyzing the determinants of education. He noted that the effect of income on the schooling of girls was larger than that of boys. Al-Samarrai and Peasgood (1998) find that household characteristics such as parental education may have a totally different impact on the education of females and males in Tanzania. Using some descriptive statistics, Bonifaz and Ochoa (2002) find that Bolivia does not present a significant gender gap in terms of total school attendance, even though minor differences emerge when considering the socioeconomic status and the living area.

4. Theoretical Framework

In order to carry out the analysis, Ravallion and Wodon's (2000) theoretical framework is adopted, as they jointly analyze the decision of working and schooling when school incentives are provided by the government. In fact, as noted in Section 2, the school feeding programs provided by the government makes this framework appropriate.

It is assumed that parents are free to determine the time allocation of their children. In addition, assuming that parents are altruistic and want the best for their kids, they will allocate their time to school, leisure and labor depending on the household's socioeconomic characteristics.

Drawing from Basu and Van (1998), if no school incentive is available and if households' wages are too low, families will be forced to send their children to work in order to survive. However, if the government provides children with incentives for schooling, households' decisions on their children's allocation of time may vary according to the relationships occurring among leisure, school and work. In particular, as in Ravallion and Wodon (2000), it is assumed that families have the following utility function:

$$U = U(C; S; H; Z) \quad (1)$$

where C is consumption, S stands for schooling, H is leisure and Z is a vector of household characteristics. In addition, the child's total time available is:

$$T = S + H + L \quad (2)$$

where L is the time devoted to labor. Considering w as the wage received for working and b as the incentive received to enroll/attend school, the budget constraint faced by the families is:

$$C = wL + bS + Y(Z) \quad (3)$$

where $Y(Z)$ represents the household's income as a function of the above mentioned vector of household characteristics. Therefore, if parents maximize the utility function subject to the time available and the budget constraint, the latter can be rewritten as:

$$C + (w - b)S + wH = wT + Y(Z) \quad (4)$$

Note that $(w-b)$ is the price of attending school[11]. Thus, w and b are turn out to be crucial when allocating time. Assuming strict quasi-concavity of the utility function, the problem here is to evaluate the impact of an increase of school incentive on labor. As shown in Ravallion and Wodon (2000), the impact of an increase of the subsidy on labor can be analyzed considering the Slutsky decomposition:

$$\frac{\Delta L}{\Delta b} = \frac{\Delta S}{\Delta(w-b)} + \frac{\Delta H}{\Delta(w-b)} - S\frac{\Delta(H+S)}{\Delta(wT+Y(Z))} \qquad (5)$$

Under the concavity assumption of U, the first and third term are strictly negative. On the other hand, the second term might be either positive or negative. Therefore, the effect of a subsidy that increases schooling has an ambiguous effect on child labor. More specifically, if leisure and schooling are (utility-compensating) substitutes, a school incentive may have either no or positive impact on child labor. On the other hand, the effect on child labor is negative if schooling and leisure are complements. Thus, in the former scenario child labor increases or stays the same as schooling increases, whereas in the latter child labor decreases.

According to the previous setup, by identifying the determinants of school attendance, enrollment and child labor in Bolivia, the empirical analysis as described in the following section allows inferring how Bolivian households allocate time and thus whether these goods are complements or substitutes. More specifically, the evaluation of the determinants across time (1999-2007) helps shading light on the dynamics of the joint schooling/child labor

[11] The final constraint can be obtained by pricing the amount of time by w (as the wage determines the price of the time). Moreover, by inserting wT in the initial constraint on both side of the equation and rearranging, the final constraint is obtained.

decisions made by different groups such as (not) indigenous and (not) extremely poor households.

5. Empirical Strategy

This section describes the chosen empirical strategy, while the model specification is illustrated in the following subsection.

The enrollment, attendance and working decisions are modeled assuming that these are made by a representative agent within the household wishing to maximize his or her family's welfare.

Therefore, a linear random utility function is employed, where the utility associated with both the decision to enroll or not to enroll the child in primary school is assumed to be a linear function of a set of household's socio-economic characteristics (X_i), and of a stochastic term, which represents unobservable and measurement errors (ε_i). Hence, the indirect utility of household i associated with the enrollment decision $(U_{i,E})$ and not enrollment $(U_{i,N})$ can be expressed as:

$$(U_{i,E}) = X_i\beta_E + \varepsilon_{i,E} \quad (6)$$

$$(U_{i,N}) = X_i\beta_N + \varepsilon_{i,N} \quad (7)$$

Thus, the representative agent of the household i will choose to enroll the child if the utility associated with the decision is higher than the utility associated with the alternative decision: $(U_{i,E}) > (U_{i,N})$. If a variable Y is defined such that $Y_{i,E} = 1$ if the i^{th} household enrolls the child and $Y_{i,E} = 0$ if it does not, the probability that the i^{th} household enrolls the

child is $(Y_{i,E}=1)=\Pr(U_{i,E}>U_{i,N})=\Phi\left[X_i(\beta E-\beta N)\right]$, where Φ is the cumulative distribution function of $\varepsilon_{i,E}-\varepsilon_{i,N}$.

Normalizing the utility of not enrolling the child in school to zero $(U_{i,N}=0)$ it is possible to derive the empirical equation for the enrollment decision:

$$\Pr(Y_{i,E}=1)=\Pr(U_{i,E}>0)=\Phi\left[X_i\beta\right] \quad (8)$$

Similarly, other two equations are derived to model the probability of the same household i to let the child attend school and work:

$$\Pr(Y_{i,A}=1)=\Pr(U_{i,A}>0)=\Phi\left[X_i\theta\right] \quad (9)$$

$$\Pr(Y_{i,W}=1)=\Pr(U_{i,W}>0)=\Phi\left[X_i\gamma\right] \quad (10)$$

where $U_{i,A}$ and $U_{i,W}$ are the indirect utilities associated with sending the child to school and to work.

Therefore, it is possible to empirically analyze the household's determinants of enrollment, attendance and working behavior through the estimation of β, θ and γ parameters in the empirical equations (8), (9) and (10).

The most common econometric regression procedure to estimate these equations by Maximum Likelihood Estimation (MLE) is the Probit model[12]. It assumes that the error term

[12] The alternative is to use Logit regressions, assuming an error term logistically distributed. However, the Probit model has been preferred because of its theoretical extensions associated to the multivariate Probit methodologies.

is normally distributed with mean zero and variance equal to one, and $\Phi(.)$ is the cumulative distribution function for a standard normal random variable. Nonetheless, a possible issue with this approach is that it does not consider the correlation among the household's decisions on enrollment, attendance and working. Hence, the univariate approach estimation of the three correlated equations is not a fully efficient econometric procedure, as it ignores the correlation among the error terms.

Due to the clear interrelation among the dependent variables of interest, the estimation method must reflect the joint decision making process. More specifically, enrollment, attendance and working cannot be treated as independent decisions. This rules out the possibility of using a multinomial Logit model since it assumes that all variables are considered independent. That is, as already considered by Wabha (2006), using a multinomial Logit model would imply that the decision to work is independent or, in other words, not affected by whether or not a schooling option is available. It should be noted that the empirical works aiming at analyzing jointly the schooling and working decisions did not pay enough attention to the interdependence problem. For example, Psacharopoulos (1997), Patrinos and Psacharopoulos (1997) as well as Ravallion and Wodon (2000), when modeling schooling and working do not allow for a multivariate specification that would have tackled the endogeneity among the dependent variables. Only Wabha (2006) uses a bivariate Probit procedure in modeling child labor and schooling.

Thus, given the hypothesis of interdependence among the three variables of interest, a trivariate Probit model (Triprobit) is employed. This, in fact, allows for the existence of possible correlated disturbances.

$$\Pr(Y_{i,E}=1)=\Phi[X_i\beta] \tag{11}$$

$$\Pr(Y_{i,A}=1)=\Phi[X_i\theta] \tag{12}$$

$$\Pr(Y_{i,W} = 1) = \Phi[X_i \gamma] \tag{13}$$

In this model, the error terms follow a trivariate normal distribution:

$$\begin{aligned} &E(\varepsilon_{i,E}) = E(\varepsilon_{i,A}) = E(\varepsilon_{i,W}) = 0 \\ &V(\varepsilon_{i,E}) = V(\varepsilon_{i,A}) = V(\varepsilon_{i,W}) = 1 \\ &Cov(\varepsilon_{i,E}, \varepsilon_{i,A}, \varepsilon_{i,W}) = \rho \end{aligned} \tag{14}$$

The evaluation of the likelihood function requires the computation of trivariate normal integrals. For example:

$$\begin{aligned} &\Pr(Y_{i,E} = 0, Y_{i,A} = 0, Y_{i,W} = 0) = \\ &\int_{-\infty}^{-X_i\beta} \int_{-\infty}^{-X_i\theta} \int_{-\infty}^{-X_i\gamma} \phi_W(\varepsilon_{i,E}, \varepsilon_{i,A}, \varepsilon_{i,W}, \rho_{12}, \rho_{13}, \rho_{23}) d\varepsilon_{i,E} d\varepsilon_{i,A} d\varepsilon_{i,W} \end{aligned} \tag{15}$$

The model is estimated by the method of simulated maximum likelihood (SML). In particular, the Geweke-Hajivassiliou-Keane (GHK) smooth recursive simulator is used to evaluate the three-dimensional Normal integrals in the likelihood function (see Hajivassilious et al., 1995).

For each observation, a likelihood contribution is calculated for each replication, and the simulated likelihood contribution is the average of the values derived from all the replications. The simulated likelihood function for the sample as a whole is then maximized using the standard maximum likelihood technique.

Given the nature of the data, the Triprobit methodology does not consider fully the character of the correlation (selection) between the variables in this empirical case. In fact,

the enrollment decision determines completely the possibility of attending school, selecting households that can actually take the latter decision, and a non-random sample selection could generate biased estimates as specified in Heckman (1979). An econometric approach that can be considered to deal with this problem is to specify a tivariate Probit with sample selection model, and adapt the Heckman two-step procedure to this dichotomous case (Van de Ven et al., 1981). However, the lack of an instrumental variable did not allow the authors to adopt such extension.

Moreover, the longitudinal dimension of the data is not explored, as any methodology that takes it into account (i.e. pseudo panel or pooled cross sections) would not allow investigating the substitution and complementary relationships of the dependent variables over the considered period.

Gouriéroux and Montfort (1997) show that under standard conditions the SML estimator is consistent as the number of observations and the number of draws tends to infinity, and is asymptotically equivalent to the true maximum likelihood estimator as the ratio of the square root of the sample size to the number of draws tends to zero.

Note that since the Triprobit is an ad-hoc procedure, the calculation of the marginal effects and their standard deviations is not provided by the standard statistical packages. Therefore, both the marginal effects and the standard deviations have been computed using the procedure suggested by Anderson and Newell (2003) and subsequently corrected by Carlevaro and Sénégas (2006).

5.1. The Model

Considering the methodological issues presented in the previous section, the following equation is estimated for each year:

$$\Pr(Y=1) = \Phi(\alpha + \beta_0 Age + \beta_1 Male + \beta_2 Indigenous + \beta_3 Urban + \beta_4 Spanish + \beta_5 EdMHead + \beta_6 EdFHead + \beta_7 ExtPoverty + \beta_8 BJP) \quad (16)$$

Where Y is the probability of the event Enrollment in the first equation, Attendance in the second one and Working in the last one.

Note that, apart from Age, all the variables used in the equations are dichotomous. The dependent variable Enrollment takes the value one when the child is enrolled in the current year into primary school and zero otherwise. Attendance takes the value one if the child answers that he is currently attending the course he got into during the current year and zero otherwise. Finally, Working takes value one when the child answers that he worked at least one hour during the previous week and zero otherwise.

Beyond the continuous variable Age, a set of dummy variables has been added as regressors of the three equations. Namely, Male identifies a male child; Indigenous takes the value if the child answers positively the question about his feeling of belonging to an indigenous group and zero otherwise. However, since many children were not able to answer this question, those who have both the mother and the father declaring to belong to an indigenous group are also defined as indigenous. Urban, Spanish and Poverty identify a child that respectively lives in an urbanized area, can speak Spanish as first or second language, and that is living in extreme poverty conditions13 and zero otherwise14.

Moreover, EdMHead (educated male head) and EdFHead (educated female head) have been added to the equations. These take the value of one if the child belongs to a family with an educated male or female head, and zero otherwise. A head is defined as educated if he or she has completed at least primary school.

[13] The definition of extreme poverty used in the surveys is based on the Unsatisfied Basic Needs (NBI) Index.
[14] For 1999, the variable Poverty does not use the definition of extreme poverty due to the lack of data.

Finally, using the available data the impact of the BJP is analyzed by adding a dummy variable in the 2007 regression that identifies those who received such scholarship in 2006.

6. Empirical Analysis

This section firstly describes the data employed and illustrates some descriptive statistics. Secondly, the results from the estimation of the model are presented and discussed.

6.1. Data and Descriptive Statistics

The data used in this paper was obtained from Bolivia's national household survey MECOVI[15] for 1999, 2000, 2001, 2002, 2005, 2006 and 2007. This survey is conducted at the end of each year, typically in November and December.

The age of entry in primary school is six and the duration of compulsory education is eight years. Therefore, samples of children who are between five and fifteen years[16] are selected in this analysis. The academic year is composed of about forty weeks, five days a week and four hours per day.

The focus of the analysis does not encompass private schools[17], as the enrollment and attendance behaviors are likely to be driven by different factors.

Table 1 shows the proportions of children for each of the above mentioned characteristics.

[15] MECOVI is a regional program that aims at standardizing household surveys in the Latin American and Caribbean region, funded by the World Bank, the Inter-American Development Bank, and the United Nations.

[16] A slightly wider age interval has been used to allow for children that go to school one year before or one year later the traditional age of entry.

[17] The percentage of those enrolled in private schools is on average below 10 percent.

[Table 1 about here]

It is relevant to note that the population is fairly distributed in many of its features as gender, ethnic origin, living area and extreme poverty.

In fact, the proportion of male children in the population is roughly the same of the female one. Moreover, the proportion of indigenous children is slightly higher than the non-indigenous one. Likewise, extremely poor children are faintly more than non-extremely poor ones in all but one year (data in 1999 are out of the average because the definition of poor instead of extremely poor has been adopted). In the last two years, the proportion of children coming from urban areas exceeded the one of those coming from rural ones, albeit maintaining a certain level of symmetry in the population.

Finally, children speaking Spanish are more than 90 percent in all years and it is quite unusual for a child to have an educated head, but it is relatively more common that this is the father instead of the mother.

The data presented in Table 2 shows the proportions of children enrolled in primary public school, attending it and carrying out working activities. It is clear that the percentage of enrolled children has been increasing over the considered years. However, the attendance proportions do not show any clear pattern, and displays the worst value in 2007 after some years of improvement. Finally, the working proportions seem to be relatively stable over the years.

[Table 2 about here]

Although the figures on enrollment are suggesting that the country is on path for achieving universal primary education, attendance proportions cast doubts on the fulfillment of the target relative to the completion of primary school.

Table 3 presents the proportions of children who enroll/attend primary school and those of children that are involved in working activities given the same characteristics.

[Table 3 about here]

Unsurprisingly, indigenous children enrolled less than non-indigenous ones. However, the gap has been reducing over time, nullifying the difference between the two groups. More interestingly, the proportion of children who attend primary school is somwhat higher for indigenous people than for non-indigenous ones for all the years. Therefore before 2002, indigenous children enrolled less, but if they did so, they attended more than non-indigenous ones. Likewise, even when the enrollment proportions became roughly equal, indigenous children attend relatively more. Looking at the working proportions, it is clear that indigenous children work more than non-indigenous ones. However, after a peak in 2005, the indigenous proportion started to decrease by more than 5 percentage points each year, whereas the non-indigenous remained the same.

If a child is extremely poor, he is less likely to enroll in primary school, but, again, if he does so, he attends more than a non-extremely poor one. For both extremely and non-

extremely poor the enrollment proportion has increased, while the attendance proportion is quite volatile and no clear trend emerges. As expected, extremely poor children work more than non-extremely poor ones.

Figure 1 illustrates the working proportion gap between extremely poor and indigenous children.

[Figure 1 about here]

The gap from being negative became positive and progressively widened, reaching its maximum amplitude in 2006 and 2007. Given that indigenous and extremely poor children report similar child labor proportions, this suggests that indigenous children reduced labor compared with extremely poor children. On the contrary, extremely poor children seem not having reduced child labor (see also Table 3). Moreover, given that both groups increased attendance as discussed above, it is then relevant to further investigate whether or not indigenous (and poor children) were able to substitute (complement) schooling and working.

Living in an urbanized area seems to be important for enrolling although this feature seems to lose importance in the last two years. As for the indigenous people, the proportion of not enrolled children from the rural areas has been substantially declining across the considered period, whereas it has been only slightly reducing for those not enrolled in the urban areas. Interestingly, children from rural areas tend to attend primary school more than those living in urban areas, contrary to the general belief.

Spanish-speaking children usually enroll in school much more than non-Spanish-speaking ones. As mentioned, this has been one of the main focuses of the ERP that

addressed the problem through the Intercultural Bilingual Educational Program. As for the indigenous, a non-Spanish speaking child, when enrolled, tends to attend more than a Spanish speaking one. Non-Spanish speaking children tend to work more than Spanish speaking ones. Nonetheless a downward trend in the last three years is observable.

Gender does not seem to be an issue for the enrollment and attendance in Bolivia; however, if for both males and females the proportion of enrolled children improves across years (in particular from 2005), this is not true for the attendance behavior. Males tend to work more than females for all but one year. Yet, the surveys do not provide a detailed household members' domestic activity section for all years. Therefore, it is important to be aware about a potential bias.

Finally, the education of the head seems to play a relevant role in let children enrolling and in taking them away from labor.

6.2. Presentation and Interpretation of the Results

Table 4 and 5 show the empirical results relative to the trivariate Probit estimation. As illustrated in Table 4, overall the cross-equation error terms appear strongly correlated, justifying the adoption of a multivariate framework and tackling the working endogeneity problem.

[Table 4 about here]

[Table 5 about here]

According to the econometric results, extremely poor children tend not to enroll in the first years of the analysis. Yet, in the last three years this pattern changes and in 2006 a positive and significant coefficient shows up. Interestingly, indigenous children are more likely to enroll than the non-indigenous ones.

Among the regressors of the enrollment equation, it is evident that urban is the most important determinant positively affecting the choice to be enrolled in primary school for the whole period.

Being able to speak Spanish positively affects the probability of being enrolled across years. In addition, older children tend to enroll less.

Averaging across years, around 60 percent of working children's fathers is not educated. In other words, parents with little or no education may not consider schooling as an investment as also noted in Whaba (2006) for Egypt. The empirical analysis supports the previous statement since having an educated parent positively affects the probability of being enrolled.

Undesirably, the gender issue is evident for almost every year under consideration. In fact, males are generally more likely to enroll in primary school.

Overall, it seems that the picture of enrollment of children in primary school is positive and improving across time. The proportion of not enrolled children drop from 9.2 percent in 1999 to 4.4 percent in 2007 and the empirical analysis of the determinants as in Tables 4 and 5 shows that the increase of enrollment happens in urban areas and among indigenous.

Regrettably, the attendance analysis does not draw the same encouraging picture. As seen in Table 2, the proportion of children who attend school is on average clearly below 60

percent. In other words, almost all the children enrolled in primary school but few attended it. Thus, it turns out to be crucial to analyze the determinants of attendance.

The most interesting and important variables in the attendance equation are indigenous and extreme poverty. The indigenous variable reports the strongest positive marginal effect in the attendance equation and the impact shows an upward trend over the years, achieving about 20 percent in 2007. Such result could be linked to the effects of the inclusive policies for people belonging to indigenous groups. Moreover, it is clear from Tables 4 and 5 that being extremely poor has a positive and significant impact in most of the years. In addition, in the last two years the marginal effects increase up to 14 percent. It seems plausible that extremely poor children are more motivated than non-extremely poor ones to attend school because of school feeding and conditional cash transfers programs adopted in several municipalities in Bolivia. In this sense, attending school turns out to be very important for an extremely poor child and the family.

The Spanish variable is positive and significant in most of the years, highlighting that not being able to speak Spanish not only discourages children to enroll, but also represents an obstacle for the children to attend. Therefore, it seems that policies that introduced the bilingual intercultural education were not successful.

As for the enrollment probability results, older children tend to attend less. However, the magnitude of the marginal effects is quite low after 2000.

Children with educated parents are more likely to attend school, although this is not as evident as for the enrollment equation.

The coefficients of the Urban variable show an interesting trend. From 2000 through 2002 children in urban areas attended school more than those in rural areas. Nevertheless, the trend has changed across time and in the last two years the coefficients become negative and

significant. This is in line with previous results, in that extremely poor indigenous children tend to live in rural areas.

The results relative to the BJP variable deserve special attention. Note that those children who benefited from the scholarship in 2006 tend to enroll, but do not attend school in 2007. This is particularly evident when considering that the variable has the highest marginal effect in the 2007 enrollment equation while it reports a negative but not significant sign in the attendance equation. Thus, children get only the first installment (that is the one due at the enrollment act), foregoing the second one (disbursed at the end of the academic year). Therefore, it seems that this program encourages free riding behavior since children seem to take advantage of it without caring about the learning phase.

Finally, the working estimation results help to better understand the interaction among the three phenomena. Child labor is mainly concentrated in rural areas and parental education plays a relevant role in reducing the probability of the child to engage in working activities.

The variable age shows a positive and significant effect in all the years under analysis. This is likely to be due to the increase in child labor productivity as age rises. Unsurprisingly, those who do not speak Spanish tend to work more.

Being indigenous generally leads to child labor across the initial years. However, the effect of such determinant diminishes afterwards and in the last two years is not significant. In other words, indigenous children are less likely to work after 2005, the year of the election of the first indigenous President Morales. On the other hand, it can be observed an increasing and significant impact of the extremely poor variable across years. Therefore, as already noted from Figure 1, despite indigenous children reduced working, the reverse is true for extremely poor children.

Being male is a relevant determinant of child labor. Nevertheless, it should be remembered that the definition of working does not encompass the domestic work, typically

carried out by females. Therefore, such coefficients could be biased as noted in Contreras et al (2006).

Interestingly, the BJP variable reports a positive though not significant coefficient and this is an important finding that comes along with the result of the BJP in the attendance equation. More specifically, not only the BJP seems not to increase school attendance but it also does not discourage children to leave working activities.

To sum up, the decision of attending school is mainly driven by indigenous people and by a welfare improvement of the extremely poor families. In other words, extremely poor families need to benefit from the higher income provided by both child labor and school attendance. Although schooling programs oriented to extremely poor children achieved some positive results, the proportion of enrolled children who do not attend school is still high and those poor who attend are not able to forgo the income coming from labor. Accordingly, it seems that the "luxury assumption" by Basu and Van (1998) does not hold in the case of Bolivia since the majority of children attending primary school are extremely poor. Nevertheless, the Bolivian context is characterized by incentives that are not considered in the authors' framework.

Finally, the empirical results allow explaining how schooling/labor decisions interact across different groups and time. More specifically, given the theoretical framework considered in section 4, two clear features seem to emerge from our analysis. In fact, empirical evidence shows that in Bolivia there is no substitution between working and schooling among extremely poor children. However, the same cannot be argued for the indigenous children, who became able to substitute between such goods. It should be also observed that attending school seems to be an option for non-extremely poor families and this should be taken in consideration in order to implement further educational policies oriented to increasing school attendance.

7. Conclusions

This paper contributes to the existing education literature by analyzing the determinants of school enrollment, attendance and working in Bolivia from 1999 to 2007.

Using a trivariate Probit model, evidence is found of a significant increase in enrollment among indigenous children and children living in urban areas. In general the proportion of not enrolled children in primary school is steadily decreasing achieving 4.4 percent in 2007. However, about 40 percent of the enrolled children are not attending school. When analyzing the determinants of the attendance behavior, poverty and indigenous turn out to be the most important characteristics. Nonetheless, the same variables show different patterns in the working estimation. In fact, if indigenous children are progressively quitting their job, extremely poor cannot.

The enrollment figures look promising when evaluating the achievement of the second MDG on universal primary education, but suggest that further efforts are required to allow children to attend school and abandon work activities.

Education policies aiming at spreading primary education to indigenous and extremely poor children seem to have produced positive effects. More specifically, inclusive policies toward the indigenous, school feeding and conditional cash transfer programs allowed indigenous and poor children to attend school. On the other hand, the BJP initiative seems to encourage free riding behavior, leading people to enroll but not to attend. The reason of it might be that the second installment of the BJP is not large enough for many extremely poor children to forgo working.

Thus, it is evident that the attendance decision, corresponding to the learning phase, is led by a plain welfare improvement of the extremely poor families rather than an investment

for the future. In fact, it can be inferred that there is no substitution between working and schooling among extremely poor children. In other words, as already found by Ravallion and Wodon (2000) in the case of Bangladesh, it seems that child labor does not displace schooling among extremely poor individuals in Bolivia. On the contrary, indigenous children became able to substitute between such goods.

There are three main caveats of the analysis. First, as mentioned, the absence of domestic work data could bias the obtained results with relation to the gender issue. Second, the analysis is carried out at the national level, disregarding any different dynamic that is occurring at the local level. Finally, the absence of a good instrument to control for the selection problem could be a potential source of bias.

The results have four main policy implications. Policies aiming to foster enrollment in rural areas should be promoted. At the same time, incentives and measures to stimulate school participation need to be revised in order to encourage child labor abandonment by the poorest. Moreover, a different setting of the installments of the BJP should be devised to avoid free riding and consequently promote human capital growth. Finally, educational policies should not forget those non-extremely poor children that are fully enrolled but hardly ever attend school.

Table 1: Proportions in the population

	1999	2000	2001	2002	2005	2006	2007
Male	51.2	50.8	50.6	50.9	53.6	52.4	50.6
Female	*48.8*	*49.2*	*49.4*	*49.1*	*46.4*	*47.6*	*49.4*
Indigenous	63.8	53.5	58.5	54.8	54.7	50.9	51.3
Non-indigenous	*36.2*	*46.5*	*41.5*	*45.2*	*45.3*	*49.1*	*48.7*
Urban	43.1	46.5	43.3	49.2	45.3	56.7	57.4
Rural	*56.9*	*53.5*	*56.7*	*50.8*	*54.7*	*43.3*	*42.6*
Spanish	99.1	97.0	93.7	91.2	98.7	96.8	95.0
Non-Spanish	*0.9*	*3.0*	*6.3*	*8.8*	*1.3*	*3.2*	*5.0*
Ed M Head	-	-	27.8	20.0	26.9	32.2	29.9
Non-ed M Head	-	-	*72.2*	*80.0*	*73.1*	*67.8*	*70.1*
Ed F Head	-	-	4.1	10.0	5.5	5.3	6.6
Non-ed F Head	-	-	*95.9*	*90.0*	*94.5*	*94.7*	*93.4*
Extr. poor	78.4	54.4	55.6	54.3	52.4	48.5	53.4
Non-extr. poor	*21.6*	*45.6*	*44.4*	*45.7*	*47.6*	*51.5*	*46.6*
Observations	2912	4622	5848	5614	1187	3102	3165

Source: MECOVI.

Table 2: Enrollment, Attendance and Working

	1999	2000	2001	2002	2005	2006	2007
Enrollment (%)	90.8	91.1	90.9	91.1	94.6	94.2	95.6
Attendance (%)	53.2	71.2	49.5	55.0	62.1	75.4	50.6
Working (%)	26.5	19.1	22.2	20.3	17.04	19.5	21.9

Source: MECOVI.

Table 3: Enrollment, Attendance and Working Proportions

	Enrollment						
	1999	2000	2001	2002	2005	2006	2007
Male	85.9	83.5	84.9	85.1	90.9	89.5	91.3
Female	*82.3*	*82.5*	*83.1*	*83.4*	*88.2*	*86.2*	*89.2*
Indigenous	81.1	82.0	84.0	84.4	89.6	88.2	89.6
Non-indigenous	*88.6*	*83.8*	*83.2*	*84.8*	*89.6*	*87.7*	*90.4*
Urban	90.2	87.6	88.7	88.2	94.0	89.7	91.5
Rural	*77.8*	*77.9*	*78.8*	*80.1*	*84.9*	*86.2*	*88.8*
Spanish	84.0	84.2	85.6	86.0	90.4	88.4	90.9
Non-Spanish	*42.9*	*29.5*	*61.6*	*67.9*	*54.8*	*76.8*	*79.4*
Ed M Head	-	-	85.8	84.7	95.6	90.7	92.8
Non-ed M Head	-	-	*82.5*	*78.9*	*87.2*	*87.0*	*88.1*
Ed F Head	-	-	90.8	88.6	96.9	95.5	92.5
Non-ed F Head	-	-	*84.6*	*73.1*	*83.5*	*83.3*	*91.1*
Extr. poor	82.7	80.4	81.9	82.2	88.0	87.2	89.3
Non-extr. poor	*89.3*	*85.9*	*86.4*	*86.8*	*92.1*	*88.9*	*91.5*
	Attendance						
	1999	2000	2001	2002	2005	2006	2007
Male	55.0	67.7	52.1	59.9	62.3	73.0	48.3
Female	*54.9*	*65.0*	*52.5*	*59.7*	*58.4*	*74.7*	*50.6*
Indigenous	62.4	73.5	55.4	66.8	74.4	81.9	58.8
Non-indigenous	*40.0*	*58.1*	*45.7*	*49.2*	*40.9*	*60.5*	*33.6*
Urban	43.2	60.6	55.8	67.7	54.8	66.5	42.4
Rural	*69.0*	*73.6*	*48.1*	*50.4*	*67.4*	*81.3*	*58.1*
Spanish	52.5	65.7	51.5	60.9	60.1	73.8	49.0
Non-Spanish	*50.4*	*77.8*	*69.4*	*58.4*	*94.8*	*73.7*	*60.0*
Ed M Head	-	-	52.4	60.3	57.6	69.4	50.7
Non-ed M Head	-	-	*50.4*	*48.5*	*61.5*	*76.8*	*47.4*
Ed F Head	-	-	51.1	63.2	70.3	57.7	44.7
Non-ed F Head	-	-	*62.0*	*56.5*	*59.3*	*70.3*	*54.8*
Extr. poor	58.9	72.5	52.7	60.6	67.2	82.0	59.2
Non-extr. poor	*41.9*	*60.1*	*51.9*	*58.9*	*54.2*	*64.7*	*38.7*
	Working						
	1999	2000	2001	2002	2005	2006	2007
Male	26.4	20.6	23.2	23.0	31.0	24.4	21.9
Female	*26.1*	*15.8*	*18.3*	*18.6*	*22.6*	*22.0*	*17.5*
Indigenous	31.0	24.1	25.4	25.9	35.3	30.0	24.6
Non-indigenous	*17.2*	*11.5*	*14.4*	*14.2*	*15.2*	*15.4*	*15.6*
Urban	8.8	6.7	7.8	7.4	10.2	6.4	5.4
Rural	*45.1*	*31.7*	*35.9*	*36.0*	*45.2*	*40.2*	*36.8*
Spanish	37.0	27.2	20.1	18.8	26.3	22.3	19.0
Non-Spanish	*85.8*	*75.4*	*36.8*	*45.3*	*64.7*	*60.5*	*39.7*
Ed M Head	-	-	17.7	20.2	14.1	12.2	10.0
Non-ed M Head	-	-	*22.7*	*33.8*	*34.7*	*32.0*	*27.7*
Ed F Head	-	-	12.8	14.2	8.5	3.7	8.8
Non-ed F Head	-	-	*23.2*	*33.0*	*32.1*	*19.9*	*19.3*
Extr. poor	29.5	23.8	26.1	27.8	36.2	33.4	28.0
Non-extr. poor	*15.0*	*12.1*	*14.9*	*12.8*	*16.8*	*11.9*	*10.3*

Source: MECOVI. – appears whenever the number of observations is below 10.

Table 4: Enrollment, Attendance and Working Coefficients: Trivariate Probit Regressions

	Enrollment						
	1999	2000	2001	2002	2005	2006	2007
Age	-.334***	-.435***	-.184***	-.169***	-.412***	-.231***	-.258***
	(-5.66)	(-7.70)	(-10.25)	(-9.77)	(-6.09)	(-6.76)	(-5.43)
Male	.413***	.159	.060	.168**	.184	.323***	.078
	(3.48)	(1.45)	(0.86)	(2.54)	(1.37)	(3.15)	(0.57)
Indigenous	.073	.149	.271***	.203***	.104	.419***	.320**
	(0.53)	(1.25)	(3.83)	(2.91)	(0.78)	(3.70)	(2.40)
Urban	.856***	.627***	.616***	.348***	.361**	.400***	.379***
	(6.61)	(5.20)	(7.88)	(4.35)	(2.02)	(3.51)	(2.57)
Spanish	.808	1.204***	.744***	.548***	.822**	.613**	.292
	(1.29)	(4.86)	(5.35)	(5.08)	(2.32)	(2.48)	(1.11)
EdMHead	dropped	dropped	-.005	.255**	.494***	.634***	.383**
			(-0.06)	(2.44)	(2.64)	(4.35)	(2.10)
EdFHead	dropped	dropped	-.009	.258*	5.451***	.582*	.111
			(-0.05)	(1.67)	(29.94)	(1.79)	(0.30)
Extr. poor	-.040	-.257**	-.113	-.129*	-.030	.234*	-.190
	(-0.23)	(-2.25)	(-1.49)	(-1.76)	(-0.22)	(1.89)	(-1.25)
BJP	.	.	.	.	.	.	.845***
							(4.29)
Constant	.823	1.102**	.584***	.630***	.212	.603**	1.371***
	(1.19)	(3.39)	(3.83)	(4.01)	(0.55)	(2.26)	(4.35)
	Attendance						
	1999	2000	2001	2002	2005	2006	2007
Age	-.168***	-.208***	-.018*	-.022**	-.161***	-.052***	-.001
	(-3.43)	(-4.98)	(-1.74)	(-2.25)	(-3.38)	(-3.51	(-0.04)
Male	.190*	.065	-.008	.028	.116	.066	-.073
	(1.91)	(0.77)	(-0.18)	(0.59)	(1.18)	(0.97)	(-1.10)
Indigenous	.297***	.450***	.299***	.619***	.788***	.497***	.569***
	(2.69)	(4.91)	(5.88)	(12.07)	(7.69)	(7.17)	(8.34)
Urban	-.235**	.230***	.439***	.647***	.048	-.157**	-.186**
	(-2.28)	(2.65)	(8.92)	(11.94)	(0.43)	(-2.05)	(-2.35)
Spanish	.865	.961***	-.196*	.189**	.275	.451**	.216
	(1.27)	(3.95)	(-1.64)	(2.08)	(0.72)	(2.09)	(1.30)
EdMHead	dropped	dropped	.012	.247***	.081	.206***	.385***
			(0.22)	(2.77)	(0.70)	(2.62)	(5.09)
EdFHead	dropped	dropped	-.099	.296**	.572**	.144	.300*
			(-0.71)	(2.44)	(2.16)	(0.83)	(1.91)
Extr. poor	.038	.100	.016	.149***	.152	.371***	.415***
	(0.30)	(1.14)	(0.33)	(2.88)	(1.45)	(5.07)	(5.63)
BJP	.	.	.	.	.	.	-.023
							(-0.29)
Constant	-.652	-.573*	-.299**	-1.084***	-.829*	-.400*	-.842***
	(-0.92)	(-1.90)	(-2.32)	(-8.50)	(-2.09)	(-1.75)	(-3.31)

Table 4 (*Continued*)

	Working						
	1999	2000	2001	2002	2005	2006	2007
Age	.11**8	.234***	.138***	.158***	.145***	.151***	.141***
	(2.36)	(4.57)	(11.93)	(13.84)	(3.05)	(7.97)	(7.00)
Male	-.052	.286***	.238***	.254***	.350***	.123	.214**
	(-0.47)	(2.94)	(4.29)	(4.59)	(3.36)	(1.37)	(2.52)
Indigenous	.280**	.164***	.160***	.174***	.431***	.087	.010
	(2.23)	(1.52)	(2.71)	(3.07)	(4.03)	(1.05)	(0.12)
Urban	-1.105***	-.808***	-1.003***	-.986***	-.964***	-1.083***	-1.175***
	(-9.32)	(-8.12)	(-17.07)	(-16.18)	(-8.73)	(-11.11)	(-12.91)
Spanish	-.773*	-.799***	-.367***	-.610***	-.398	-.534**	-.154
	(-1.65)	(-3.22)	(-2.95)	(-6.83)	(-1.14)	(-2.41)	(-0.92)
EdMHead	dropped	dropped	-.074	-.157*	-.277**	-.111	-.231**
			(-1.17)	(-1.76)	(-2.03)	(-0.78)	(-2.28)
EdFHead	dropped	dropped	-.159	-.043	-.522*	-.604	-.274
			(-1.04)	(-0.31)	(-1.82)	(-1.61)	(-1.11)
Extr. poor	.148	.117	.147**	.159***	.145	.472***	.239***
	(1.07)	(1.22)	(2.54)	(2.60)	(1.40)	(5.26)	(2.54)
BJP	.	.	.	.			.104
							(1.08)
Constant	.289	-.560*	-.491***	-.262**	-.319	-.324	-1.990***
	(0.55)	(1.64)	(-3.63)	(-2.01)	(-0.87)	(-1.34)	(-6.73)
Log ps. Likelihood	-8.2e+5	-7.5e+5	-1.7e+6	-1.8 e+6	-8.0 e+5	-1.6 e+6	-1.6 e+6
Wald Test (ρ=0)	280.91	269.60	783.83	950.09	3831.58	501.22	608.30
(Prob> Chi2)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)
Observations	935	1416	4517	4459	1186	2421	2487
ρ 21	.677***	.808***	.467***	.580***	.493***	.517***	.419***
	(13.33)	(26.59)	(14.18)	(19.88)	(7.17)	(10.45)	(7.65)
ρ 31	-.382***	-.450***	-.145***	-.241***	-.253***	-.266***	-.051
	(-6.21)	(-8.08)	(-3.54)	(-6.09)	(-3.66)	(-4.12)	(-0.61)
ρ 32	-.265***	-.405***	-.082**	-.132***	-.014	-.049	.042
	(-4.35)	(-6.92)	(-2.44)	(-4.20)	(-0.22)	(-0.95)	(0.86)
LR test	1.6e+6	1.5e+6	3.5e+6	3.7e+6	1.6e+6	3.4e+6	3.2e+6
(Prob> Chi2)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)

Source: Authors' estimations based on MECOVI. In 1999 and 2000 the variables EdFhead and EdMhead have been dropped because there are very few educated heads.
Notes: The number in parenthesis report z-statistics. Estimations performed using the expansion factor. *** Significant at 1%, **significant at 5%, * significant at 10%.

Table 5: Enrollment, Attendance and Working Marginal Effects: Trivariate Probit Regressions

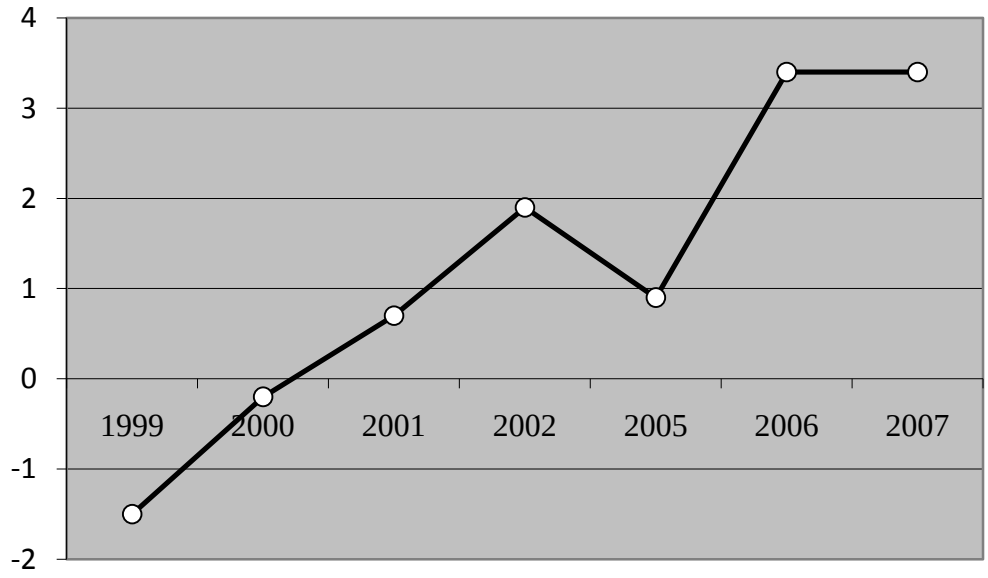
	Enrollment						
	1999	2000	2001	2002	2005	2006	2007
Age	-.107***	-.117***	-.065***	-.058***	-.163***	-.082***	-.048***
	(-2.36)	(-4.24)	(-7.98)	(-7.85)	(-6.15)	(-4.95)	(-2.60)
Male	.097*	.032*	.020	.052***	.070**	.096***	.012
	(1.36)	(1.29)	(0.87)	(2.46)	(1.39)	(2.63)	(0.57)
Indigenous	.020	.030	.083***	.062***	.040	.120***	.040*
	(0.49)	(1.13)	(3.52)	(2.69)	(0.76)	(2.96)	(1.53)
Urban	.159	.093**	.164***	.100***	.133*	.115***	.045**
	(1.22)	(2.10)	(6.13)	(4.01)	(2.02)	(2.90)	(1.69)
Spanish	.154	.125**	.187***	.145***	.265**	.161**	.037
	(0.83)	(1.87)	(3.98)	(3.93)	(1.90)	(1.97)	(0.91)
EdMHead	dropped	dropped	-.002	.076**	.176***	.165***	.045**
			(-0.63)	(2.25)	(2.70)	(3.30)	(1.68)
EdFHead	dropped	dropped	-.003	.077**	.416***	.155**	.016
			(-0.52)	(1.69)	(2.78)	(2.11)	(0.31)
Extr. poor	-.011	-.064**	-.039*	-.044**	-.012	.072**	-.033
	(-0.23)	(-1.81)	(-1.51)	(-1.81)	(-0.22)	(1.73)	(-1.36)
BJP	.	.	.	.	.	.	.072**
							(1.70)
	Attendance						
	1999	2000	2001	2002	2005	2006	2007
Age	-.051*	-.066***	-.007**	-.005**	-.042**	-.019***	-.000
	(-1.56)	(-2.96)	(-1.74)	(-2.13)	(-2-25)	(-3.39)	(-0.42)
Male	.065*	.023	-.003	.006	.034	.025	-.020
	(1.53)	(0.76)	(-0.17)	(0.58)	(1.09)	(0.97)	(-1.07)
Indigenous	.104**	.168***	.117***	.182***	.280***	.194***	.192***
	(1.98)	(4.59)	(5.94)	(8.58)	(5.16)	(7.32)	(6.89)
Urban	-.070*	.082***	.173***	.192***	.014	-.056**	-.048**
	(-1.43)	(2.47)	(8.93)	(7.70)	(0.42)	(-2.05)	(-2.20)
Spanish	.327*	.368***	-.072*	.046**	.086	.176**	.065*
	(1.48)	(4.46)	(-1.59)	(2.17)	(0.79)	(2.21)	(1.38)
EdMHead	dropped	dropped	.005	.062***	.023	.079***	.124***
			(0.22)	(2.85)	(0.66)	(2.55)	(4.09)
EdFHead	dropped	dropped	-.037**	.076***	.195**	.054	.094**
			(-0.72)	(2.32)	(1.79)	(0.82)	(1.74)
Extr. poor	.012	.035	.006	.036***	.046*	.144***	.134***
	(0.30)	(1.13)	(0.33)	(2.86)	(1.38)	(5.17)	(5.34)
BJP	.	.	.	.	.	.	-.006
							(-.29)

Table 5 (*Continued*)

	Working						
	1999	2000	2001	2002	2005	2006	2007
Age	.044**	.085***	.050***	.062***	.056***	.058***	.048***
	(1.97)	(5.44)	(9.51)	(13.47)	(2.87)	(6.97)	(5.56)
Male	-.020	.104***	.089***	.100***	.137***	.048*	.074***
	(-0.47)	(2.55)	(4.18)	(4.59)	(3.31)	(1.37)	(2.47)
Indigenous	.101**	.058*	.058***	.068***	.170***	.033	.003
	(1.95)	(1.56)	(2.72)	(3.00)	(4.11)	(1.06)	(.12)
Urban	-.406***	-.202***	-.244***	-.291***	-.275***	-.293***	-.228***
	(-6.29)	(-3.18)	(-7.81)	(-9.96)	(-3.53)	(-5.21)	(-4.33)
Spanish	-.299*	-.200***	-.116***	-.205***	-.138	-.178**	-.048
	(-1.67)	(-2.10)	(-2.65)	(-5.90)	(-1.05)	(-1.31)	(-.87)
EdMHead	dropped	dropped	-.026	-.059**	-.099**	-.041	-.070**
			(-1.18)	(-1.72)	(-2.06)	(-.79)	(-2.26)
EdFHead	dropped	dropped	-.054	-.016	-.175**	-.196**	-.081
			(-1.08)	(-0.31)	(-1.96)	(-1.92)	(-1.21)
Extr. poor	.055	.041	.054***	.062***	.056*	.186***	.083***
	(1.03)	(1.24)	(2.56)	(2.62)	(1.41)	(5.43)	(2.61)
BJP	.	.	.	.	.	.	.035
							(1.09)

Source: Authors' estimations based on MECOVI. In 1999 and 2000 the variables EdFhead and EdMhead have been dropped because there are very few educated heads.
Notes: The number in parenthesis report z-statistics. Estimations performed using the expansion factor. *** Significant at 1%, **significant at 5%, * significant at 10%.

Figure 1: Child Labor Proportions Gap (Extremely Poor vs. Indigenous)



Source: MECOVI.

Conclusions

The objective of this thesis is fourfold. First, it investigates the effectiveness of macroeconomic policies in the recoveries periods in the MENAP countries. Second, it explores the effects of the MTEF adoption on the main fiscal performance indicators. Third, it identifies the nexus between the excess of liquidity and commodity prices; in particular, it assesses whether the commodity prices react more powerfully than the consumer goods' prices to changes in real money balances. Finally, it investigates the determinants of primary school enrollment, attendance and child labor in Bolivia, with a special attention at identifying the substitution and complementary relationships between schooling and working.

The analysis carried out in the first chapter suggests that episodes of negative non-oil output growth are quite rare in MENAP countries. Also, non-hydrocarbon output growth in oil-exporting MENAP countries has on average been higher than output growth in the other MENAP countries but also more volatile. The MENAP's hydrocarbon exporters experienced more severe recessions in the 2000s than in the 1990s; this likely reflects the downturn in the industrial countries in the aftermath of the bursting of the high-technology stock market bubble in the early 2000s and the delayed effect of the low oil prices in 1998-1999. By contrast, the other MENAP countries' slowdowns were milder in the 2000s reflecting improvements in their policy frameworks made since the mid-1990s. The other MENAP countries' slowdowns in the 2000s were mostly caused by spillover effects from hydrocarbon exporters in the region. The duration of output gap recessions increased for all MENAP countries from the 1990s to the 2000s. The duration of recoveries also increased somewhat over the two decades.

Fiscal stimulus is associated with stronger recoveries in both groups of MENAP countries; there is also evidence that the impact of fiscal policy is weaker in countries with a higher openness to trade in line with leakage effects. Monetary policy *per se* does not appear

to have played a significant role in stimulating recoveries; its limited effectiveness is likely to be related to the stabilized and pegged exchange rate regimes operated by the countries in the sample which limit the scope for independent monetary policy and renders changes in money endogenous rather than a variable that policymakers can control. Other main determinants of the strength of recoveries are the pre-recovery non-oil trade openness to GDP ratio and the public debt to GDP ratio, as well as the growth of real exports.

The second chapter studies the impact of the MTEF adoption on fiscal performance. The data reveal patterns in the timing of MTEF adoption across regions and levels of development. The OECD countries were the first to adopt MTEFs, and by the early 1990s most countries in this group had an MTPF in place. The bulk of MTEF reforms in Sub-Saharan African countries took place in the 1990s. Latin American countries adopted MTEFs in the 1990s and 2000s, and Eastern Europe and the former soviet republics join the trend in the 2000s. Asian countries, however, do not display a clear adoption pattern. MTEF adoption is very likely endogenous to internal fiscal conditions, which makes the adequate identification of MTEF effects challenging. In this paper, in order to identify MTEFs' impacts the differential patterns of MTEF adoption across regions are exploited.

Both the event study analysis and the econometric results suggest that MTEF adoption strongly improves fiscal discipline and that there is a larger effect with each successive MTEF phase. At the same time, although the event study analysis fails to provide a clear picture, the econometrics analysis reveals that MTBFs improve allocative efficiency. Finally, the MTPF seems to be the only MTEF phase that exerts a significant effect on technical efficiency, although the results are not always robust. As for the regulatory and political factors, it is found that being a member of the OECD has a favorable effect, however none of the other variables influence the effectiveness of an MTEF.

In the third chapter, it is investigated weather consumer prices and commodity prices react to an excess liquidity in the US within a Cointegrated VAR framework, and if the different price elasticities of supply for goods and commodities allow for differences in the dynamic paths of price adjustment to a liquidity shock.

The results show a positive relationship between real money and real commodity prices and provide empirical evidence for a stronger response of the commodity prices with respect to the consumer goods' prices. This could imply that, if the magnitude of the reaction is due the fact that consumer goods' prices are slower to react, then, their long-run value can be predicted with the help of the commodity prices. The results also support the idea that monetary policy cannot only focus on the core infaltion and ignore developments in the commodity market. In fact, if commodity prices are very high it might be the case that monetary policy is loose; therefore they should be taken into account as a useful monetary indicator. This conclusion is particularly relevant to those countries that are adopting an inflation targeting regime which target is the CPI.

The last chapter focuses on the determinants of school enrollment, attendance and child labor. Results at descriptive level reveal that enrollment became progressively more widespread in Bolivia. Nonetheless, the attendance figures are discouraging, as about 40 percent of the enrolled children did not go to school.

Triprobit estimations show that the increase in enrollment is led by indigenous and children living in urban areas, whereas poverty and indigenous are the main characteristics driving the attendance behavior. While school feeding and conditional cash transfers programs are likely to have allowed extremely poor children to attend school, at the same time these do not seem sufficient to let them forgo child labor. In fact, the proportion of working children seems not to be affected by school incentives since extremely poor children manage to allocate their time between school and working activities (presumably reducing

their leisure time), making those complements. On the contrary, indigenous children made them substitutes, increasing schooling and decreasing working.

Furthermore, the empirical evidence also shows that the implementation of the *Bono Juancito Pinto* (BJP) scholarship in 2006 has a negative effect on attendance in 2007 as possibly children tend to enroll to benefit of the first installment but they do not attend school afterwards. In addition, the BJP does not discourage children abandoning working activities.

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