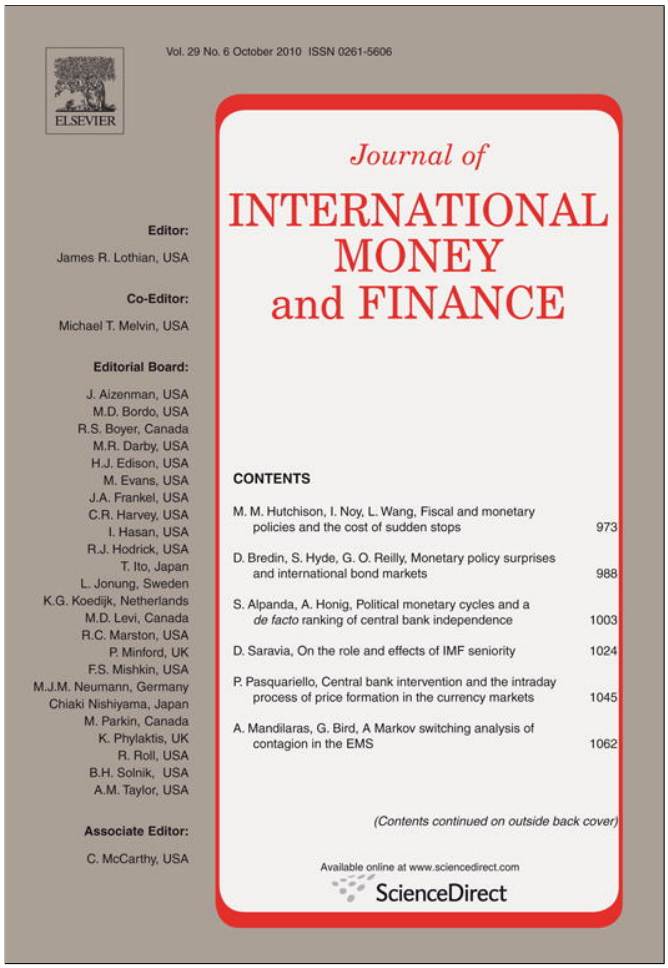

Vol. 29 No. 6 October 2010 ISSN 0261-5606

ELSEVIER

Journal of
INTERNATIONAL MONEY and FINANCE

CONTENTS

(Contents continued on outside back cover)

Available online at www.sciencedirect.com
ScienceDirect

Journal of International Money and Finance 29 (2010) 973–987

Contents lists available at ScienceDirect

Journal of International Money and Finance

journal homepage: www.elsevier.com/locate/jimf

Fiscal and monetary policies and the cost of sudden stops

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JEL classification:
E52
E62
F32
F43
O16

Keywords:
Output losses
Financial crisis
Sudden stops
Fiscal policy
Financial policy

A B S T R A C T

This article investigates the effects of monetary and fiscal policies on output growth during sudden-stop balance of payments crisis in emerging markets and developing countries. Sudden stops in capital flows, and subsequent deep recessions, are a frequent occurrence in these countries but there is no professional consensus, and little systematic empirical evidence, shedding light on the macroeconomic policy mix most likely to limit output losses during these episodes. To address this issue, we investigate 83 sudden-stop crisis in 66 countries using a baseline empirical model to control for the various determinants of output losses during sudden stops. We measure the marginal effects of policy on output losses, and find strong evidence that monetary tightening (rise in the discount rate or unsterilized rise in international reserves) and discretionary fiscal contraction are significantly correlated with larger output losses following a sudden stop. Fiscal expansion is associated with smaller output losses following a sudden stop, but monetary expansion has no discernable effect. The macroeconomic policy mix associated with the least output loss during a sudden-stop financial crisis is a discretionary fiscal expansion combined with a neutral monetary policy.

1. Introduction

The "sudden stop" of international capital inflows to developing and emerging-market economies has become a major disruptive factor in several recent financial crisis. The sudden-stop problem features an abrupt cessation in foreign capital inflows and/or sharp capital outflows leading to

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doi:10.1016/j.jimonfin.2009.12.005

a balance of payments crisis. A growing literature suggests that the collapse of investment and financial intermediation resulting from sudden stops is the main component of the very dramatic output collapses that have periodically hit many developing and emerging-market economies. More than one hundred sudden stops in capital inflows may be identified over the past twenty-five years, with an average output loss by one measure approaching almost 10 percent of GDP.[1]

Calvo et al. (2002), for example, provide a sudden-stop interpretation for the recent crisis in Argentina in which the capital flow reversal together with dramatic real exchange rate depreciation significantly worsened the government's fiscal position, led to a debt default, and an output collapse. Hutchison and Noy (2006) show that sudden stops have severe consequences for the economy, as the abrupt reversal in foreign credit inflows in conjunction with a realignment of the exchange rate typically cause a sharp drop in domestic investment, domestic production and employment. In a broader historical examination, Bordo et al. (2001) argue that the sudden-stop problem has become more severe since the abandonment of the gold standard in the early 1970s.

The IMF financial assistance programs signed by Thailand, Korea, and Indonesia during the 1997–1998 Asian financial crisis generated a very heated debate about the appropriate use of discretionary or activist fiscal and monetary policies during a crisis situation. The IMF policy recommendation, which was incorporated as an integral part of the conditionality agreements in their loan packages, called for fiscal and monetary tightening. This was articulated clearly by the IMF First Deputy Managing Director at the time, Stanley Fischer. One of the most prominent critics of this prescription was Joseph Stiglitz, then Senior Vice President and Chief Economist of the World Bank. This public disagreement on such a key policy issue among the leading economists at the two major Bretton Woods institutions was unprecedented.

Fischer argues that the prescription of tight fiscal and monetary policy is justified by the fact that the governments that entered a crisis usually face large budget deficits and high inflation. When describing Thailand, Indonesia and Korea, Fischer writes that: "The macroeconomic parts of these programs consist of a combination of tight money to restore confidence in the currency and a modest firming up of fiscal policy to offset in part the massive costs of financial restructuring" (Fischer, 1998, p. 103). Providing further detail, he writes: "On the appropriate degree of fiscal tightening, the balance is a particularly fine one. At the onset of the crisis, countries needed to firm up their finances, both to cover the costs of financial restructuring, and—depending on the balance-of-payments situation—to reduce their current account deficits, which depend in part on the budget deficit" (Fischer, 1998, p. 105).

Stiglitz, by contrast, agrees that the key monetary component is restoring confidence but argues that confidence arises out of a good macroeconomic environment and not tight policies in the midst of a financial crisis. A healthy growth rate is the best indicator, in his view, to bolster confidence and a prescription of tight money and high interest rates will do exactly the opposite. He notes that "… maintaining tight monetary policies has led to interest rates that would make job creation impossible even in the best of circumstances" (Stiglitz, 2002, p. 17). Thus, by making the recession even deeper, the policy ends up reducing confidence in the economy rather than enhancing it. Stiglitz (1999a,b) terms this the 'beggar-thyself' policy. Regarding the Asian financial crisis, he writes: "… contractionary fiscal and monetary policies combined with misguided financial policies led to massive economic downturns, cutting incomes, which reduced imports and led to huge trade surpluses, giving the countries the resources to pay back foreign creditors." (Stiglitz, 2002, pp. 107–8).

To date there is no professional consensus, based on theory or empirical studies, on which approach is more conducive to achieving growth targets following a sudden stop in capital inflows. Aghion et al. (2004) and Lahiri and Végh (2007), for example, in theoretical papers, examine the impact of monetary policy on currency crisis and conclude that contractionary monetary policy (an interest rate defense) might result in greater output contraction.[2] In contrast, Christiano et al. (2004) conclude from their theoretical work that when there are frictions in adjustment in the traded goods sector, an expansionary monetary policy during a financial crisis might be welfare reducing. Similarly, Céspedes et al.

[1] See Table 3 for details on this measure of output cost. See also Hutchison and Noy (2006) for another measure of the output cost of sudden stops (of 13–15% of GDP).

[2] In previous work, Lahiri and Végh (2003) examined the impact of an interest rate defense on crisis timing.

Table 1
Frequencies of policy choices and output outcomes in developing and emerging markets.

	Output contracted following the crisis	Output expanded following crisis	All sudden-stop crisis
Fiscal policy			
Fiscal contraction	17	8	25
Fiscal expansion	27	12	39
Total	44	20	64
Monetary policy			
Monetary contraction	5	2	7
Monetary expansion	10	1	11
No monetary change	40	25	65
Total	55	28	83
Exchange policy			
Reserve accumulation	14	4	18
Reserve de-cumulation	9	1	10
No reserve change	32	23	55
Total	55	28	83

Note: See text (Section 3) for algorithms used to identify fiscal, monetary and reserve policies pursued and for calculating the output measure (OC1) used to determine the typology above.

(2004) and Cúrdia (2007) look at exchange rate policy during currency crisis and conclude that a flexible regime is Pareto superior.[3] Razin and Sadka (2004) offer an analysis of fiscal policy in a debt crisis and describe the conditions under which increasing the budget surplus might not help even if the original trigger for the crisis was government debt; while Mitra (2006) introduces an equivalent examination and concludes that the impact of fiscal policy on the growth outcome depends on the flexibility of production.

Little empirical work has addressed the optimal policy response to a financial crisis. We attempt to fill this gap in the literature. In particular, we consider "sudden-stop" financial crisis and investigate the wide range of monetary, fiscal and exchange rate policy responses to 83 crisis that have been occurred over 1980–2003 in 66 countries. The paths of economies at the time of sudden stops vary widely (Table 1), with about 65 percent of sudden-stop crisis followed by an output contraction, and about 35 percent of the cases followed by an output expansion. In the extremes, at least by one measure (defined below), output varies from cumulative output loss (relative to trend) of over 80 percent of GDP to a cumulative gain of over 20 percent of GDP.

However, it is not clear what factors, and especially which government policies, have contributed to the wide diversity of outcomes. Some examples illustrate this point. During the 1982 Latin American crisis, Bolivia sharply contracted both money and fiscal policy, while Chile held monetary policy steady and only instituted a mildly contractionary fiscal policy. Both countries, however, experienced sharp declines in output – Bolivia on the order of 24% of GDP and Chile around 28% of GDP. In response to sudden stops, Malaysia pursued a fiscal expansion and a neutral monetary policy stance (1997) while Venezuela pursued a monetary expansion and a steady fiscal policy (1994). Both countries, despite the differences in their policy responses, experienced significant output declines.

Moreover, it is not even obvious from casual observation of the aggregate data how policies are linked to output losses during sudden stops. The top panel of Table 1 shows the number of observations (frequencies) associated with output contraction and expansion, in the columns, against observations of fiscal contraction and expansion in the rows.[4] About 2/3 of sudden stops are associated with output contractions. Of the 44 episodes of output contraction during sudden stops, 17 were associated with fiscal contraction and 27 with fiscal expansion. Of the 20 cases associated with output expansion, 8 cases were associated with fiscal contraction and 12 cases with fiscal expansion. Similarly, no simple story is apparent from monetary policy responses, shown in Table 1. The great majority of cases of either output

[3] Cúrdia (2007), in a theoretical paper, also examines the impact of various monetary policy rules on the consequences of sudden stops.

[4] Although we have 83 cases of sudden stops in the sample, we only have fiscal data for 64 cases.

contraction or output expansion were not associated with a significant change in monetary policy (73 percent and 89 percent, respectively). Monetary contractions were only followed in about 9 percent of sudden-stop episodes, and expansionary policy in about 13 percent of the cases. Only 5 episodes of the cases with output declined were associated with monetary contractions, and a similar percentage of monetary contractions were followed when output expanded during sudden-stop episodes.

The summary statistics reported in Table 1, and illustrative cases discussed above, suggest that a number of factors, working simultaneously, have influenced the evolution of output following sudden-stop crisis. Our objective is to investigate the effects of macroeconomic policies on the path of output following sudden stops while controlling for a host of variables that are also likely to play an important role. No study to date has explored this issue using a broad range of crisis experiences. Rather, the extant literature typically considers a series of case studies. These provide very valuable insights but it is difficult to derive general conclusions from them.

In our work we focus on sudden stops, since these are the crisis that have been most costly and the response to them the most controversial. The central issue we address is the effects on output from alternative macroeconomic policy responses to a sudden-stop crisis. We consider the effectiveness of monetary and fiscal policy responses, as well as various combinations of policy responses, in mitigating the output losses usually associated with financial crisis. We employ regression methods in our empirical investigations (cross-section of sudden-stop crisis episodes) to control for the wide variety of factors potentially affecting output paths of economies, and formally test several hypotheses on the effects of contractionary (expansionary) macroeconomic policy responses to financial crisis. We find that contractionary monetary and fiscal policies during a financial crisis are linked to larger economic downturns. Expansionary fiscal policy is associated with smaller output losses following a sudden stop, but expansionary monetary policy has no discernable correlation.

Section 2 reviews the literature on sudden stops and highlights our contribution. Section 3 presents the basic empirical model. Section 4 discusses the data employed in the study, and Section 5 reports summary statistics on key macroeconomic variables and the primary empirical results of the study. Section 6 concludes.

2. Why should a sudden stop cause a collapse in output?

Recent theoretical literature, following the pioneering work of Calvo (1998) and Calvo and Reinhart (2000), emphasizes the linkage between sudden stops and output losses. Calvo (1998, 2000) and Calvo and Reinhart (2000) analyze several channels through which a sudden stop in international capital flows may bring about a currency and balance of payments crisis and, subsequently, an output collapse. One mechanism may be termed the traditional Keynesian effect whereby a fall in credit, attributable to the sudden stop in capital inflows, combined with an external financing premium and a "financial accelerator," reduces aggregate demand and causes a fall in output (e.g. Bernanke et al., 1999). Furthermore, firm bankruptcies may cause negative externalities – banks may become more cautious and reduce loans. This in turn may induce a further fall in credit—the "vanishing credit effect" described in Calvo (2000) – and exacerbates an output decline.

Another mechanism, termed the Fisherian debt-deflation channel by Mendoza (2001), emphasizes that a sudden stop, given collateral constraints, might induce margin calls, a sell-off of assets and consequently a contraction of credit and output (e.g. Kiyotaki and Moore, 1997 and Mendoza and Smith, 2006).[5] In these frameworks, even though the government sector is typically not modeled, it is likely that a Keynesian prescription of expanding demand through expansionary fiscal and monetary policies would reduce the severity of a sudden-stop crisis. A third possible channel focuses on the contract enforceability/moral hazard problem as described in Schneider and Tornell (2004) and the search friction model of Gopinath (2004). Moreover, Caballero and Krishnamurthy (2002, 2004), Durdu and Mendoza (2006), and others develop models that suggest changes in the global financial architecture might lead to the prevention of sudden stops or to lowering their costs.

[5] In stark contrast, Chari et al. (2005) argue, based on a general equilibrium model, that sudden stops are expansionary and the reduction of output observed in recent crisis is due to other financial frictions that overwhelm the positive effect of sudden stops.

Until recently, however, most empirical literature has not clearly distinguished between the different types of financial crisis. Kaminsky (2006) sets out a crisis classification scheme and demonstrates that sudden stops are a special variety of financial crisis. She argues that a sudden stop, in the sense of a capital inflow reversal in tandem with a currency/balance of payments crisis, is a special type of currency crisis. Using a regression-tree classification methodology, she finds that the set of explanatory factors associated with sudden stop special crisis are different than other financial crisis. Honig (2008), Calvo et al. (2004, 2006), Cavallo and Frankel (2008) and others also empirically examine the factors explaining the occurrence of sudden stops. Several recent papers empirically analyze output developments around the time of banking or currency crisis in broad samples of countries, e.g. Aziz et al. (2000), Barro (2001), Bordo et al. (2001), Gupta et al. (2007), Hutchison and McGill (1999), Hutchison and Noy (2002, 2005) and Frankel (2005).

The empirical finding that the causes of sudden stops differ from currency, banking and "twin" (joint currency and banking) crisis suggest that the effects on the real economy are also likely to be different. Indeed, Hutchison and Noy (2006), in a large panel of countries over time, find that the costs of sudden stops are much higher than those for other types of financial crisis. Becker and Mauro (2006) also identify episodes of output collapse ('output drops') and empirically associate those with the occurrence of sudden stops. Bordo et al. (2001), Milesi-Ferretti and Razin (2000) and Edwards (2004) focus on the determinants of the costs of crisis, emphasizing the effect of structural factors such as trade openness, the size of the preceding current account deficit and the exchange rate regime.

However, no paper that we are aware has attempted to empirically measure the impact on output of the *ex-post* macroeconomic policy decisions taken in response to a sudden stop.

3. Estimating the effects of policies on the output costs of sudden stops

The first step in the analysis is to set out a benchmark model that attempts to explain output costs following a sudden-stop financial crisis by a standard set of variables. Our observational units are a cross-section of sudden-stop episodes (83 in total) and the question we address is, given the occurrence of a sudden stop, what variables and policies appear to influence its severity in terms of output losses. The benchmark output-cost model introduces relevant control variables into the regression equation, allowing us to identify the marginal effects of macroeconomic policy and limit potential omitted-variables bias. The controls are from a broad set of variables identified in the literature as important determinants of the output cost of financial crisis (see Appendix).

In the context of our benchmark model, we test for the additional effect of fiscal and monetary policies on output growth following a sudden stop (we discuss the definitions of the policy variables in Section 4).

The formal specification of the empirical model is as follows:

$$Cost_{\boldsymbol{i}} = \alpha + \beta_k \boldsymbol{X_i} + \beta_1 \Delta_{\boldsymbol{i}}^{fis} + \beta_2 D_{\boldsymbol{i}}^{mon} + \varepsilon_{\boldsymbol{i}} \quad (1)$$

Where *Cost* is the cost of the sudden stop i in terms of forgone output (deviations from trend output growth), $\boldsymbol{X}$ is a vector of control variables, Δ^{fis} is the change in discretionary fiscal policy, and D^{mon} are binary indicators for monetary expansion or monetary contraction. We consider changes in the central bank discount rate (rise or fall) and changes in international reserves (rise or fall) as indicators of monetary policy shifts. (Discount rates change the price of credit and unsterilized changes in international reserves impact the monetary base and the quantity of credit). We construct our fiscal and monetary policy variables so as to limit the likelihood that reverse causality (from output losses to policy changes) will bias our estimates. In particular, we measure only the discretionary part of fiscal policy (derived from country-specific measures of fiscal stance over time that are independent of the business cycle) and construct binary indicators for discrete changes in the monetary policy stance. These measures are described in detail in the next section.

The cross-sectional methodology we employ is less susceptible to some of the simultaneity issues more pervasive in dynamic panel and time series analyses (as in, for example, Bordo et al., 2007). Our methodology is similar to that adopted by Gupta et al. (2007) in their work on the output dynamics around currency crisis and their determinants.

4. Data description

We focus on developing and emerging-market countries since they are the subject of policy discussions and recent financial crisis and output collapses. Several studies indicate that developing and emerging-market countries are different from industrialized/developed countries with respect to the factors that make them susceptible to a financial crisis (Broner and Rigobon, 2006; Glick and Hutchison, 2005; Caballero and Krishnamurthy, 2002; and Tornell and Westermann, 2002). Specifically, these countries tend to be especially open to international capital inflows that are short-term in nature and usually denominated in foreign-currency ("original sin" in the terminology of Eichengreen and Hausman, 2005). These characteristics increase the vulnerability of developing and emerging-market economies to swings in exchange rates and cessation of new capital to roll over expiring debt.

4.1. Defining the output cost measures

There is no single commonly accepted methodology to measure the output costs of a crisis or, for that matter, the foregone output associated with a more generic economic recession. For this reason we use three alternative measures of output cost in our empirical analysis to test the robustness of our results.

Our benchmark measure is based on a methodology developed by researchers at the International Monetary Fund. The benchmark output loss measure (OC1) is constructed by comparing, in real terms, the pre-crisis GDP growth rate of a given country with the GDP growth rate during the subsequent years until the return to the pre-crisis rate of growth. The pre-crisis GDP growth is calculated as the average of GDP growth rates from year $t-3$ to $t-1$, where year t is the start of the crisis. (Windows are imposed such that only sudden-stop episodes preceded by "tranquil periods", i.e. pre-crisis periods without a sudden stop, are included in the sample.) Each GDP growth rate from year t onwards is then compared to the trend until the trend growth is reached. The output loss is defined as the sum of the difference between the actual and the trend growth rate over all the years until the trend growth is reached again.[6]

Our second output cost measure (OC2) measures the end of the crisis as three years after the original capital flow reversal. The output cost is then constructed as the difference between the real GDP growth rate in the sudden-stop episode (years t to $t+2$) and the pre-crisis GDP growth rate (years $t-3$ to $t-1$). Our third measure (OC3) assumes that the crisis continues for two years and the output cost is constructed as the difference between the average real GDP growth rate in years t and $t+1$ and the pre-crisis GDP growth rate (years $t-3$ to $t-1$).

4.2. Defining sudden stops

Calvo et al. (2004) and Cavallo and Frankel (2008) define sudden stops as any country year in which three conditions are met: (1) there is a significant reversal of capital inflows (a decrease in the financial account of at least 2 standard deviations below the country-specific sample mean), (2) any reduction in the current account deficit in either year t or in $t+1$, and (3) a fall in per capita GDP (of any amount). Hutchison and Noy (2006) define a sudden-stop crisis as one in which there is the contemporaneous occurrence of a currency crisis and a current account reversal (a change in the current account of more than 3% of GDP) while Jeanne and Ranciere (2006) use a somewhat similar definition identifying a sudden-stop episode as one in which there is a change in the capital account of more than 5% of GDP.

The latter two alternatives use more arbitrary thresholds, and so, in our study, we follow Honig (2008) in using the first two conditions in the Calvo et al. (2004) algorithm, but excluding the third condition – the output contraction requirement.[7] Thus, a sudden-stop crisis is defined as a year in

[6] If the crisis for a country are very close (less than 3 years apart), we ignore the second crisis and only include the first crisis in our sample to calculate output loss. For Cavallo and Frankel's (2008) sudden-stop episodes, Cameroon 1990, Chile 1983, Colombia 1999, Jordan 1993, Mexico 1995, and Mongolia 1991 are dropped out of our sample. If the crisis for a country are 3 years apart, we use the pre-first-crisis trend as the trend growth for the second crisis in calculating output loss.

[7] Since we are attempting to explain the wide range of output paths following sudden stops, dropping the output contraction condition appears justifies.

which the financial account decreases by at least 2 standard deviations, while the current account surplus increases (at years t or $t+1$ and by any amount).

4.3. Defining fiscal policy measures

We are interested in the discretionary fiscal policy response to a sudden-stop crisis and not in the automatic fiscal stabilizers to a decline in output. For this reason, we need to decompose the fiscal accounts into their structural and cyclical components. Identifying the discretionary response is particularly important given the endogeneity problem that is associated with the automatic component of the fiscal response in our regression framework.

The empirical literature on alternative measures of fiscal policy stance is large and somewhat controversial (see Blanchard, 1990). We employ a standard measure that attempts to measure discretionary fiscal policy by extracting both trend and cyclical measures from the budget balance, allowing us in turn to derive changes in the discretionary fiscal stance. Specifically, discretionary fiscal policy is measured as the estimated residual for each country over time from the following equation:

$$BB_t = \beta_0 + \alpha_1 y_t + \alpha_2 y_{t-1} + \beta_1 t + \mu_t \tag{2}$$

Where BB_t is budget balance (percent of GDP) of a particular country in the sample, y is the real GDP growth rate for the country, "t" is the time trend, and μ is the random error term. The change in discretionary fiscal policy for country i is defined as

$$\Delta_i^{fis} = \widehat{\mu}_t - \widehat{\mu}_{t-1} \tag{3}$$

where $\widehat{\mu}_t$ is the estimated error term from equation (2). This measure of the change in fiscal stance is constructed to be independent of output movements and avoids simultaneity bias in our estimates of Eq. (1).

In the cases that the parameter estimates are not statistically significant at the 10% significance level, we apply the following decision rules. For countries with less than 5 observations for *BB* data, we run the regression with just a constant, i.e. no trend or cyclical component. For countries with more than 5 but less than 10 observations, we run the regression with constant and time trend term. For countries with more than 10 observations, we initially run the regression with a constant, time trend and a cyclical component, and then drop the cyclical variable if it is insignificant while keeping the constant and time trend.

4.4. Defining monetary policy measures

We employ two indicators of changes in monetary policy stance. The first indicator of monetary stance is the central bank discount rate. Policy shifts are considered as country/years in which the change in the monthly discount rate exceeds two country-specific standard deviations above the country-specific mean. This follows the practice in the empirical literature that examines the effects of monetary policy on the exchange rate following a financial crisis (e.g. Baig and Goldfajn, 2001, and Goldfajn and Gupta, 2003). We employ the discount rate rather than the interbank interest rate primarily because it is the only interest rate measure widely available for developing and emerging-market countries. Another desirable feature of the discount rate is that it is under the control of the authorities, moves infrequently, and signals discrete policy shifts. We assign the years with one or more monetary tightening months the value of 1 and 0 otherwise (i.e. 1 = tightening, 0 = not tightening). Monetary expansion episodes are considered as country/years in which the change in the monthly discount rate is smaller by at least two country-specific standard deviations from the country-specific mean. We assign the years with one or more monetary tightening months the value of 1 and 0 otherwise (i.e. 1 = loosening, 0 = not loosening). Using a binary measure limits the endogeneity problem since the magnitude, rather than the direction, of the monetary reaction might correlate with output developments.

For some country years, there is ambiguity in assigning the tightening and loosening dummies. This is because there are years during which both monetary tightening and loosening occurred in different

months. In these cases, we look at the quarterly current account and financial account data to determine at which quarter the sudden stop occurred (the quarter in which current account deficit drops and financial account surplus declines). We assign the particular year as a monetary tightening (loosening) episode if discount rate during the sudden-stop quarter increased (decreased).[8]

4.5. Alternative measure of monetary policy: quantitative easing/tightening

In extensions of our basic framework we consider a second measure of monetary/exchange rate policy – international reserve changes.[9] Accumulating international reserves, to the extent that it is unsterilized, is associated with an expansion of the monetary base and a tool for quantitative monetary easing. It is a complement to lowering the discount rate. It is also a means to support the foreign-currency. Declining international reserves, to the extent unsterilized, decreases the monetary base and tightens monetary policy. It is a complement to raising the discount rate. The reserve accumulation episodes are defined as country/years in which the change in the monthly non-gold reserves exceeds two country-specific standard deviations above the country-specific mean change. We assign the years with one or more reserve accumulation months the value of 1 and 0 otherwise (i.e. 1 = reserve accumulation, 0 = otherwise). Similarly, reserve de-cumulating episodes are defined as country/years in which the change in the monthly non-gold reserves is smaller than two country-specific standard deviations below the country-specific mean change. We assign the years with one or more reserve de-cumulating months the value of 1, and 0 otherwise.

For some country years, we have doubts in assigning the reserve accumulation and reserve decline dummy variables when episodes of reserve accumulation and decline occurred in the same year. In these cases, we look at the quarterly current account and financial account data to determine at which quarter the sudden stop occurred. We then assign that year is a reserve accumulation (decline) year if the non-gold reserves during the sudden-stop quarter accumulated (decline).[10] In the cases that the quarterly data is not available, we compare the first 3-month non-gold reserves with the last 3-month non-gold reserves. We assign that year is a reserve accumulation (decline) year if the non-gold reserves during the sudden-stop quarter accumulated (declined).[11]

4.6. Control variables

The list of control variables we use in the multivariate regressions is guided by previous research (summarized in Section 2) and our concerns over omitted-variables bias. We include variables in the regressions that the extant empirical literature has shown to have influenced the magnitude of the output cost associated with sudden stops. This is important since we want control for factors, other than monetary/fiscal/exchange rate policies that are likely to influence the output path of a sudden-stop episode. We use the following variables: (1) liability (deposit) dollarization per nominal GDP; (2) An index of the degree of openness of the capital account; (3) trade openness (the sum of exports and imports as percent of GDP); (4) a binary indicator of banking crisis; (5) inflation (the average of 3 pre-crisis years' inflation to proxy for general macroeconomic stability); (6) an index of the *de-facto* exchange rate regime; (7) world interest rates (defined as the U.S. interest rate); and (8) industrial-country-wide GDP growth (defined as the GDP weighted average of the U.S., Germany and Japan)[12] The exact definitions and sources for all variables are provided in the data appendix.

[8] For the developing countries' cases, the only case in which the classification was not straightforward was Turkey (1994).

[9] Durdu et al. (2007) investigate, in a computable general equilibrium model, the importance of reserve policy during sudden stops.

[10] Those country/years are: Israel (1988), Mexico (1995), Thailand (1997), Turkey (1994), and Venezuela (1994).

[11] Those country/years are: Algeria (1990), Barbados (1982), Chile (1983), Costa Rica (1981), and Egypt (1990).

[12] We obtained an initial list of control variables based on earlier literature, in particular the specifications in Calvo et al. (2004). We narrow this list of controls based on the benchmark regression statistics. In a previous version of the paper we also used total debt service (% of exports) and a government stability index. The inclusion of these variables does not change any of our main results. We thank an anonymous referee for suggesting including world interest rates and world-wide GDP growth as additional control variables.

Table 2
Sudden stop event frequencies.

	Number of events	Frequency of events (% of sample)
Decades		
1980–1989	19	1.29
1990–1999	52	3.54
2000–2003	31	5.27
Regions		
Asia	18	3.00
Sub-Saharan Africa	19	2.47
Latin America	24	4.55
Transition economies	7	1.62
Rest of World	34	2.83

This table reports the frequencies of sudden stop events in developing and emerging-markets countries across time and space. In identifying the sudden stops, we use the Honig (2008). See Section 3 for more detail.

5. Empirical results

5.1. Descriptive statistics on sudden stops, fiscal and monetary policies

Table 2 reports the frequencies of sudden stop events. The number of sudden stops jumped markedly between the decades of the 1980s and 1990s, and climbed further in the first few years of this decade (2000–2003). Among the developing and emerging-market countries, perhaps unsurprisingly, Latin America experienced episodes of sudden stops in capital inflows most often.

Table 3 reports descriptive statistics on the output measures and the control variables (policy measures are shown in Table 1). We note that the three output measures yield different measures but their correlation is very high (0.68–0.84). The average cumulative output loss ranges from around 1.4% to 9.2%, depending on the measure employed, with large standard deviations that reflect a substantial range of experience. For the control variables, Table 3 provides summary statistics, across the cross-section of sudden-stop episodes, for liability dollarization (DLD), the *de-facto* exchange rate regime (DEFCTO), the degree of openness of the capital account (KAOPEN), a trade openness index (TRADE), the inflation rate (INFL), the percentage of sudden-stop crisis accompanied by major banking crisis (*MAJ*), an average of foreign interest rates (REAL_INT), and the World's GDP growth rate (WLD_GDP).

Table 3
Descriptive statistics for policy variables and macro-controls: developing and emerging-market economies.

Variable	*N*	Mean	S.D.	MIN	MAX
Output loss measures					
Output cost 1 (OC1)	83	−9.15	18.68	−81.28	22.38
Output cost 2 (OC2)	83	−1.36	6.48	−17.51	22.38
Output cost 3 (OC3)	83	−1.71	5.70	−21.07	16.76
Correlation of …	OC2–OC3: 0.84	OC2–OC1: 0.68		OC3–OC1: 0.77	
Control variables					
DLD	84	0.13	0.29	0	2.22
DEFCTO	75	3.68	1.30	1	5
KAOPEN	49	−0.25	1.41	−1.84	2.52
TRADE	82	83.88	44.69	21.74	216.21
MAJ	83	0.19	0.40	0	1
INFL	83	26.11	82.30	−8.62	693.98
REAL_INT	83	6.10	1.35	2.87	8.27
WLD_GDP	83	2.89	1.01	0.30	4.65

See text for algorithms used to identify the output cost measures using GDP data from the World Bank's *World Development Indicators*. For descriptions and sources of the control variables, see Appendix.

Table 4
Policy indicator regressions.

Variable	(4.1)	(4.2)	(4.3)
Intercept	−8.34007*** (−3.63)	−10.44701*** (−4.30)	−8.73216*** (−3.22)
DISCOUNTINC	−10.43180* (−1.74)		−13.47471* (-1.95)
DISCOUNTDEC	2.93287 (0.40)		2.77888 (0.31)
FISCALSURPLUS		−0.14589* (−1.82)	−0.15689* (−1.98)
Observations	82	64	64
R^2	0.04	0.05	0.11
Adjusted-R^2	0.012	0.04	0.07
F-test	1.70	3.30	2.51

Note: The table reports the output loss following a sudden stop (dependent variable is OC1) in response to a 1 unit change in the variable (associated *t*-statistic in parenthesis). ***, **, * indicate the significant level at 1, 5, and 10 percent level respectively.

Table 3 shows that the average pre-crisis inflation rate for countries experiencing sudden stops was 26% (INFL), and 19% of these episodes were accompanied by major banking crisis (*MAJ*). In addition, the average amount of foreign-currency liabilities (*DLD*, as a percent of GDP) at the time of sudden-stop episodes was 13%, but ranged from 0% to 222%. Average trade openness (*TRADE*) was over 80% of GDP (sum of imports and exports) at the point of the sudden stop, while capital market openness was appreciably lower—averaging −0.25 on an index ranging over the sample from −1.84 to 2.52 (high values indicate greater capital account openness). In terms of exchange rate regimes at the time of sudden stops (*DEFCTO*), countries on average has a high degree of rigidity (measuring 3.7 on a scale ranging from 1 to 5, with high values indicating rigidity approximately fixed rate regimes).

5.2. Model estimates

Table 4 presents estimates of Eq. (1) without control variables using the benchmark measure of output costs (OC1). Our objective is to discern whether the policy indicator variables are correlated with output losses following sudden stops. Control variables are included in Table 5 to provide more precise estimates of the marginal effect of policy variables in explaining variations in output costs. A

Table 5
Regressions with policy indicators and control variables.

Variable	(5.1)	(5.2)	(5.3)	(5.4)
Intercept	−6.70754 (−0.80)	14.25801 (0.92)	−12.37911** (−2.45)	2.81167 (0.16)
DISCOUNTINC	−9.28456 (−1.26)	−8.49917 (−1.16)	−14.34684** (−2.60)	−14.16191** (−2.52)
DISCOUNTDEC	9.86694 (0.85)	11.62127 (1.00)		
FISCALSURPLUS	−1.89597*** (−2.88)	−2.11140*** (−3.13)	−1.91266*** (−3.69)	−2.04761*** (−3.78)
RESERVED	−16.64839* (−1.70)	−18.04364* (−1.85)	−21.56279** (−2.70)	−21.19422** (−2.70)
RESERVEA	1.37837 (0.21)	2.63273 (0.39)		
DEFCTO	−2.36040 (−1.13)	−2.21939 (−1.07)		
DLD	7.84776 (0.95)	8.76226 (1.06)		
TRADE	0.04793 (0.77)	0.04961 (0.80)	0.07381 (1.59)	0.06644 (1.39)
MAJ	−3.41089 (−0.45)	−4.21097 (−0.56)	−6.51561 (−1.18)	−6.41214 (−1.14)
INFLATION	0.08470 (0.87)	0.10169 (1.05)	0.12635 (1.14)	0.09817 (0.84)
KAOPEN*TRADE			−0.03012 (−1.57)	−0.03399 (−1.63)
REAL_INT		−3.42287 (−1.72*)		−2.23134 (−1.01)
WLD_GDPG		−0.25968 (−0.11)		0.07968 (1.04)
Observations	54	54	46	46
R^2	0.33	0.38	0.55	0.56
Adjusted-R^2	0.17	0.19	0.46	0.45
F-test	2.12	2.06	6.51	5.06

Note: The table reports the output loss following a sudden stop (dependent variable is OC1) in response to a 1 unit change in the independent variable (associated *t*-statistic is given in parenthesis). ***, **, * indicate the significant level at 1, 5, and 10 percent respectively.

negative value indicates a loss of output (cost), so that a positive (negative) coefficient on an explanatory variable implies that the variable decreases (increases) the cost of a crisis. In this set of specifications, our sudden-stop crisis sample is constructed based on the Honig (2008) criteria which allows (at most) 83 crisis observations. In the set of regressions described in Table 4, only the policy indicators are included as explanatory variables.

Column 4.1 reports results with the monetary policy variables, and column 4.2 reports results with the fiscal policy variable. In column 4.1, we find evidence that monetary tightening sharply increases the cost of a sudden stop (by 10 percentage points), significant at the 10% level, while the impact of a monetary expansion is not significantly different from zero (though the coefficient is positive). In column 4.2, the coefficient estimate indicates that contractionary fiscal policy also sharply increases output costs, and the coefficient is also statistically significant at the 10% level. The specification reported in column 4.3, where both monetary and fiscal policy is included, again indicates a strong link between monetary and fiscal contractions and the output costs of sudden stops. Only 11 percent of the variation in output costs ($R^2 = 0.11$) is explained by this equation, however, suggesting that a more complete model with other explanatory variables is needed.

Table 5 includes control variables for both domestic and external factors with our policy indicators. Including control variables reduces the number of observations (due to missing values for particular countries during particular sudden-stop episodes), but greatly increases the explanatory power of the model (to over 56 percent in one specification) thereby providing a preferable baseline by which to measure the effects of the policy indicator variables on output costs. Overall, there is strong evidence that monetary tightening, either by increasing the discount rate or contracting base money by sales of international reserves, and tightening fiscal policy (increasing the cyclically adjusted fiscal surplus), exacerbates the output cost of sudden stops. Ten of the twelve coefficients are statistically significant at the 95 percent level of confidence or higher. All have the predicted sign. Fiscal policy expansion appears to support the economy, and lessen the output losses. Loosening money policy, by contrast, appears to have no discernable effect on output costs.

More specifically, Columns 5.1 and 5.2 include the full range of policy indicators—fiscal policy (FISCAL), increases in the discount rate (DISCOUNTINC), decreases in the discount rate (DISCOUNTDEC), accumulation of international reserves (RESERVEA) and decline of international reserves (RESERVED). We also include a number of control variables – de-facto exchange rate regimes (DEFCTO), liability dollarization (DLD), trade openness (TRADE), banking crisis (MAJ) and inflation (INFLATION). We also proxy for the state of the world economy by including a measure of global output growth (WLD_GDP), and an average of large industrial-country (G3) real interest rates (REAL_INT).

The fiscal indicator and reserve decline are highly significant policy indicator variables in columns 5.1 and 5.2. A one percentage point rise in the (cyclically adjusted) fiscal surplus increases output losses following a sudden stop by about 2 percentage points. Selling international reserves (to support the currency and/or contract the money supply) also significantly reduces output losses, presumably via a monetary contraction. Tightening of monetary policy (raising the discount rate) has the 'correct' sign but is not significant at conventional levels. The loosening measures—lowering the discount rate or accumulating international reserves – are not statistically significant. It appears that tightening fiscal and monetary policy exacerbates the economic downturn following a sudden stop. Loosening fiscal policy also supports output following a sudden stop, but loosening monetary policy has no discernable effect.

Columns 5.3 and 5.4 report regression results where only the significant policy variables are included, i.e. tightening of monetary policy, cyclically adjusted fiscal surplus and reserve decline, and a smaller set of control variables. These are the strongest results. The explanatory power of the equations rise to 55–56 percent (R^2) and the three monetary tightening and fiscal indicators are highly significant with the expected signs. Explaining this percentage of the variation in output losses across sudden-stop episodes is impressive given the wide variety of experience and country-specific factors involved. In terms of coefficient estimates, the results indicate that an increase of the discount rate (of more than two standard deviations) will exacerbate the output contraction following a sudden stop by more than 10 percentage points. We also find a large and significant deterioration in output following a sudden stop during episodes of fiscal tightening and sales of international

reserves. A one percentage point rise in the (cyclically adjusted) fiscal surplus is associated with about a 2 percentage point decline in output, and a sharp decline in international reserves is associated with a 16 percentage point decline in output after controlling for other domestic and international factors.

5.3. Robustness tests

In order to evaluate the robustness of our results, we estimated the basic specifications shown in Tables 4 and 5 using our alternative measures for output cost (OC2 and OC3). The results reported above carry over to these series of regressions as well, perhaps not surprisingly given the high correlation between our three output cost measures. We do not report the results of these robustness tests for brevity.

As an additional robustness check, we re-define the fiscal policy measures as a pair of binary variables that denote expansionary/non-expansionary and contractionary/non-contractionary fiscal stances. These binary variables are constructed from the discretionary policy measure described in the data section and are equivalent to the monetary policy measures described before. The results of all our main benchmarks remain identical when using these binary fiscal measures.[13]

6. Conclusions

This article investigates the effects of macroeconomic policy on output growth during financial crisis characterized by a "sudden stop" in net capital inflows in developing and emerging-market economies. Sudden stops in capital flows, usually followed by deep recessions, are a frequent occurrence in these countries but there is no professional consensus, and little systematic empirical evidence, shedding light on the macroeconomic policy mix most likely to limit output losses during these episodes. Our objective is to determine whether policy responses, after controlling for initial conditions, have an impact on the path of output following sudden stops and may help to explain the wide variety of experiences across these episodes—usually large drops in output but occasionally more moderate downturns or little discernable effects. To address this issue, we investigate 83 sudden-stop crisis in 66 countries using a baseline empirical model to control for the various determinants of output losses during sudden stops.

Simple descriptive statistics do not show a discernable pattern between the costs of financial crisis and economic policy. Once controlling for various pre-conditions and other factors, however, we find that monetary and fiscal tightening at the time of a sudden-stop crisis are associated with much larger output losses. Contractionary monetary and fiscal policies in the midst of a sudden-stop financial crisis either exacerbate the recessionary consequences, or at least are highly correlated with large output losses, associated with these episodes, and these adverse effects are economically large. Moreover, we find that selling off international reserves, and thereby tightening domestic credit conditions, also worsens the output losses following sudden stops. Discretionary fiscal expansion, by contrast, is associated with smaller output losses during these episodes. Monetary expansion has no discernable effect. This basic result is robust to different measures of output costs, different samples and after controlling for a host of variables that may influence the path of output during a sudden-stop financial crisis. Contractionary macroeconomic policies during financial crisis may have some value in terms of stabilizing balance of payments, and perhaps even catalyzing capital flows, but are also strongly correlated with larger output losses.

Acknowledgement

We thank Eduardo Cavallo, Menzie Chinn, Adam Honig, and Hiro Ito for providing us with data and an anonymous referee for many helpful suggestions.

[13] All these results are available from the Corresponding author upon request.

Appendix A: Data sources and definitions

Output cost 1 definition (OC1):

OC1 is constructed by comparing, in real terms, the pre-crisis GDP growth rate of a certain country with the GDP growth rate during the following years until the pre-crisis rate is reached. This approach considers pre-crisis GDP growth rates to be the trend or a country's potential growth rates. The pre-crisis GDP growth is calculated as the average of GDP growth rates from year $t-3$ to $t-1$, where year t is the start of the crisis. Then, each GDP growth rate from year t onwards is compared to the trend until the trend growth is reached. The output loss is defined as the sum of the difference between the actual and the trend growth rate over all the years until the trend growth is reached again.

Variables used to construct the dependent and macroeconomic policy variables:

• Annual real GDP growth		*WDI*, NY.GDP.MKTP.KD.ZG
• Monthly non-gold reserves, US dollar		*IFS*, Line 1l.d
• Monthly discount rate, % per year, end of period		*IFS*, Line 60
• Annual budget balance (% of GDP)		*WDI*, GB.BAL.OVRL.GD.ZS
Control variables		
• Foreign liabilities (% of GDP)	DLD	*IFS*, Line 26c
• Trade openness Exports and imports (% of GDP)	TRADE	*WDI*, NE.EXP.GNFS.ZS *WDI*, NE.IMP.GNFS.ZS
• Inflation rate	INFL	*WDI*, FP.CPI.TOTL.ZG
• Banking crisis	MAJ	Hutchison and Noy, 2005
• Capital account liberalization index	KAOPEN	Chinn and Ito, 2006
• De-facto exchange rate regime	DEFCTO	Levy-Yeyati and Sturzenegger, 2003
• World GDP growth rate	WLD_GDPG	*WDI*, NY.GDP.MKTP.KD.ZG
• US interest rate	REAL_INT	*WDI*, FR.INR.RINR

Appendix B: Sudden-stop episodes in non-OECD countries.

Albania	1990	1995	Indonesia	1997	
Algeria	1990		Iran, I.R. of	1999	
Angola	2000		Israel	1988	1998
Antigua and Barbuda	1998		Jamaica	2002	
Argentina	2001		Jordan	1992	
Barbados	1982	2002	Macedonia, FYR	1999	
Bolivia	1982		Malaysia	1994	1997
Botswana	1993		Malta	1995	2000
Brazil	2002		Mauritius	2001	
Cameroon	1988		Moldova	1995	
Cape Verde	1990	2000	Mongolia	1990	
Chile	1982	1998	Morocco	1995	
China, P.R.: Mainland	1998		Nicaragua	1986	
Colombia	1998		Oman	1987	1999
Comoros	1988		Pakistan	1998	
Costa Rica	1996	2000	Panama	2000	
Cyprus	1998		Peru	1983	1998
Dominica	1996	2001	Philippines	1997	
Dominican Republic	2002		Poland	1994	2001
Ecuador	1983	1999	Solomon Islands	1998	

(*continued on next page*)

(*Appendix continued*)

Egypt	1990		South Africa	2000	
El Salvador	1999		St. Vincent & Grens	1999	2002
Fiji	1999		Swaziland	1999	
Gabon	1989		Syrian Arab Republic	1989	
Gambia, The	1982		Thailand	1997	
Ghana	2000		Tonga	1985	1989
Grenada	1999		Trinidad and Tob	1984	
Guinea	1989		Tunisia	2000	
Guyana	1995		Ukraine	1998	
Haiti	1999	2002	Uruguay	2002	
Honduras	2000		Vanuatu	1991	
Hungary	1996		Venezuela	1994	
India	1995		Zimbabwe	1983	1994

*Sudden-stop episodes identified in this table are based on the Honig (2008) definition.

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