The dynamic consequences of inflow-driven *Sudden Stops* on economic growth

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Con un infinito sentido de amor y gratitud,
para mami y papi.

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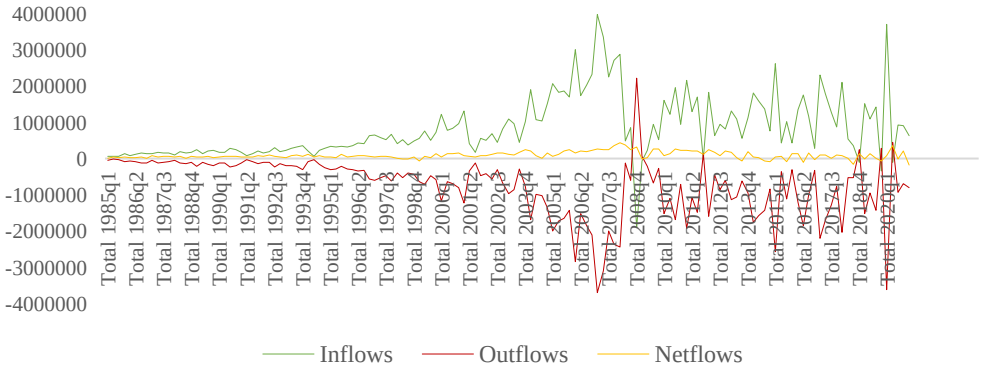
ABSTRACT

This thesis studies the effects of sudden stops (an unexpected cut-off in international capital flows) on economic growth worldwide from 1990 to 2021. For this purpose, the thesis has set two objectives. Firstly, following the typology of Cavallo et. al. (2013), the thesis carries out an updated study of different types of sudden stops that have occurred in this period. Secondly, the thesis focuses on two specific types of shocks: sudden stops in gross inflows (SSI) and sudden stops in gross inflows that are also sudden stops in net flows (SSIN), given their major effects on economic growth. The goal is to understand the transmission channel through which these types of shocks affect economic growth over time. This implies the use of methodological innovations to understand the dynamic consequences of these shocks on GDP growth. In general terms, our results suggests that during the last decade, sudden stops come back to 1990's trends. This means that net sudden stops gained prevalence in developing economies and gross sudden stops gained prevalence in developed economies. Regarding the effects of inflow-driven sudden stops on GDP, SSIN are effectively the most disruptive shocks, but SSI also show significant effects. The transmission mechanism differs between the two shocks. The former implies a forced current account adjustment, whereas the latter implies a forced deleveraging process.

INTRODUCTION

International financial integration is perhaps one of the most salient features of the post-Cold War world. The last three decades have seen a significant increase in capital flows to and from most countries, regardless of whether they are developed or developing economies. This increase in capital flows, however, brings with it some challenges, such as the amplification of financial system vulnerabilities or the aggravation of macroeconomic instability. That is why advances in the literature on international capital integration would be incomplete without rigorous analysis of the risks involved; for example, *sudden stops*. They are an unexpected cut-off in international capital flows, which have proven to be costly in terms of economic growth. These types of shocks precisely began to be studied during the second half of the 1990s, as a way of understanding the challenges imposed by this new reality. From then on, the study of sudden stops has been relentlessly evolving.

Figure 1. International capital flows for all countries 1985-2021 (Millions USD)



In this context, the ultimate goal of this thesis is to contribute to the comprehension of sudden stops; their definitions, their behaviours, their consequences. Although the study of extreme movements in international financial flows can be traced much earlier, the study of sudden stops itself is a relatively new field of study. There are still many lines of research that can be explored. The need to advance research on sudden stops lies in their potential contribution to economic policies. In fact, the purpose of studying these events is to point out the essential discussions that must precede rigorous policy decisions aimed at reducing vulnerability to them. International financial integration seems irreversible and sudden stops have become a regular feature of this new financial landscape.

The most recent literature on sudden stops has been dedicated to surgically examinate their formation and composition process (Cavallo et al., 2013 or Hwang et al., 2017). This has resulted in the simultaneous study of gross and net capital flows. Nowadays, it is possible to talk about sudden stops in gross inflows (non-resident flows) and gross outflows (resident

flows), which may or may not result in sudden stops in net flows. For instance, it could be the case that inflows and outflows move in opposite direction, so net flows remains stable. It could also be the case that the sudden stop in one of the gross flows is too large, causing by itself a sudden stop in the net flows. Then, based on this decomposition, some studies, such as Cavallo et al. (2013) or Hwang et al. (2017), have been devoted to identify which type of sudden stop has larger effects on gross domestic product (GDP). A shared finding is that net or gross sudden stops related to major declines in inflows tend to be the most disruptive. This thesis thus departs from this conclusion, in order to study of the transmission mechanisms that explain the effect of inflow-driven sudden stops on economic growth.

In particular, the objective of this thesis is twofold. Firstly, the thesis aims to carry out an updated study of different types of sudden stops, from 1990 to 2021. The idea is to analyse the behaviour of all sudden stops that have occurred in this period, both in gross and net flows. This analysis will provide an overview of these shocks worldwide, but also will help to understand the empirical concept of inflow-driven sudden stops. Secondly, once we have identified all types of shocks, the thesis focuses on two of them: sudden stops in gross inflows (SSI) and sudden stops in gross inflows that are also sudden stops in net flows (SSIN), given their major effects on GDP. The goal is to understand the transmission channel through which these two types of shocks affect GDP over a time horizon. Consequently, there are two guiding questions in this thesis: a) what have been the main trends of sudden stops from 1990 to 2021 around the world, in terms of quantity (frequency) and quality (typology)?, and b) what are the dynamic effects of SSI and SSIN on the GDP?

Before answering both questions, the thesis presents the literature review on sudden stops. The review begins by explaining the emergence of the concept and goes on to identify the two main generations of literature on this topic. The first generation aims to explain mainly the causes of sudden stops, while the second generation focuses on their impacts. In this way, it is possible to better understand the studies conducted on the consequences of sudden stops for economic growth. These latter studies can be traced back to 2004, but their main upswing began after the global financial crisis (GFC).

Now, regarding the first question, the thesis sets three specific objectives: identify, classify and analyse the behaviour of all kinds of sudden stops. To that end, we use the Financial Account of the Balance of Payments (BOP), from the International Monetary Fund (IMF). Our dataset contains quarterly information on 124 countries, from 1990 to 2021. This results in about 12800 country-year-quarter observations. However, not all the information is available for all countries in all periods. The thesis uses the algorithm proposed by Calvo, Izquierdo y Mejía (2004), to identify sudden stops in inflows, outflows and net flows. Then, following the typology designed by Cavallo, et. al. (2013), it is possible to identify seven types of sudden stops:

1. **SSI:** a sudden stop in inflows that does not imply a sudden stop in net flows;
2. SSO: a surge in outflows that that does not imply a sudden stop in net flows;
3. SSN: a sudden stop in net flows that does not imply a sudden stop in inflows nor outflows;
4. **SSIN**: a sudden stop in inflows that implies sudden stop in net flows;
5. SSON: a sudden surge in outflows that implies a sudden stop in net flows;
6. SSION: a sudden stop in inflows and a sudden surge in outflows, which together imply a sudden stop in net flows; and
7. SSIO: a sudden stop in inflows and a sudden surge in outflows, that do not imply a sudden stop in net flows (although theoretically a possibility, it has never happened).

Considering this disaggregation of the concept of sudden stop, the thesis analyses the main trends by decade. In particular, it seeks to contribute to a better understanding of the decade from 2010 to 2020, a period that has been understudied in the literature.

Concerning the second question about the impact of inflow-driven sudden stops on GDP, the thesis analyses the dynamic effect of SSI and SSIN. In that sense, the thesis could be seen as an extension of previous studies. On the one hand, Cavallo, et. al. (2013) study the effect of SSI and SSIN on GDP. Since they created the aforementioned typology, they are the first to study SSIN and SSI as specific types of shocks. They use BOP data, from IMF. Their period of analysis goes from 1980 to 2010 and contains information on 63 countries. However, they use a static approach to estimate the effect on GDP. This method does not allow to identify if the effect of the shock is perceived immediately and/or later. This also does not allow us to know the time that an economy needs to absorb these shocks.

On the other hand, Hwang, et al. (2017) study the effect of net sudden stops on GDP. They also use BOP data, from IMF. Their period of analysis goes from 1980 to 2008 and contains information on 44 countries. They identify all sudden stops in the net flows and then look at the gross flows to detect whether they are primarily driven by inflows (containing SSIN) or outflows. Evidently, their classification excludes SSI, as they are sudden stops in gross inflows only. To estimate the effect on GDP, they do use a dynamic approach: panel vector autoregressive (PVAR). However, they do not consider the cumulative effect to estimate the absorption time of the shock. It is important to note, as mentioned above, that the main objective of these two studies is to identify which type of sudden stop has larger effects on GDP. Both coincide in the prominence of inflow-driven shocks. However, in neither case do the authors analyse in depth the transmission channels or the shock absorption time.

Thus, following the studies about the effect of inflow-driven sudden stop on GDP, the thesis aims to make two contributions to the literature. Firstly, to analyse by means of a dynamic approach the effect of both gross and net sudden stops caused by decreases in inflows (SSI and SSIN). Our empirical strategy is based on the impulse-response function (IRF) estimated

by local projections, a method proposed by Jordà (2005). The thesis also considers the average cumulative response (ACR), which allows us to estimate the time that an economy requires to overcome the shock. Secondly, the thesis aims to trace the mechanism by which each of these two sudden stops affects GDP. To that end, the thesis considers the effect of the shock on other variables beyond GDP, so that it is possible to determine causal effects. While the literature offers more tools for understanding net sudden stops, gross sudden stops still require more analysis.

The main findings regarding the study of all sudden stops reveal singular features of each decade. During the 1990s, sudden stops were mainly inflow-driven net sudden stops. They usually occurred in developing countries. In the 2000's, inflow-driven net sudden stops started to occur also in developed countries, whereas developing economies experienced a rise in gross sudden stops. There is also an important increase in outflow-driven episodes in net and gross flows. Finally, during the 2010's, we come back to 1990's trends. This means that net sudden stops gain prevalence in developing economies and gross sudden stops gain prevalence in developed economies. The most notable feature, however, is a proliferation of net sudden stops driven by mild movements in gross flows, known as SSN. They are net sudden stops that do not imply a sudden stop in any of the gross flows.

Regarding the second research question, the findings differ between SSIN and SSI. In the first case, they are effectively the most disruptive shock. Their effect is perceived immediately and lasts for approximately two years. The transmission channel is related to a depreciation of the real exchange rate (RER). That effect unleashes a series of consequences, provoking a significant drop in imports, in consumption and, most importantly, in investment. All this leads to a decrease in GDP. In the second case, SSI show a much smaller but still significant effect. Their consequences become evident from the fourth quarter following the start of the shock. However, they are much longer lasting. In this case, the transmission mechanism is not related to RER devaluation. Our evidence suggests that SSI affect GDP due to a forced deleveraging process. Unlike SSIN, SSI shocks imply a radical fall of the level of foreign deposit in the domestic banking system, meaning that economic actors face sudden financial constraints, what could have destabilizing effects.

The remaining of the thesis is structured as follows. Chapter I presents the literature review. Chapter II is devoted to answer the first research question. Therefore, it carries out the analysis of the main trends in sudden stops worldwide. It presents the methodology implemented to identify sudden stops, as well as the main results. Chapter III responds the second research question. It is dedicated to analyse the effect of SSI and SSIN on GDP. It first explains the dynamic approach used to answer the question, then it presents the empirical results for both shocks separately. Finally, the conclusion seeks to expand on the main findings of the thesis and suggests possible research lines that can be pursued further. It also proposes to read the results in the light of an increasingly integrated global context.

CHAPTER I. LITERATURE REVIEW

It is not the speed that kills you, but the sudden stop

The aim of this chapter is to provide an overview of the trajectory of studies on sudden stops. An insight into the evolution of the literature will give a better understanding of the research that has been done on the economic consequences of these shocks. In that sense, the chapter begins by explaining the emergence of the concept of sudden stop. It continues by describing the two main generation of analysis on this topic. Finally, it explains in greater detail the work that has been done on the relationship between sudden stops and economic growth.

1.1. The emergence of the sudden stop concept

20 December 1994 has been established as the beginning of the Tequila Crisis in Mexico (Arancibia and Ramírez, 1995). It began, *grosso modo*, as an exchange rate crisis, which spread to the banking sector. The result was an abrupt cut-off of international funding sources, but not only for Mexico. On 28 December 1994, the Argentinian newspaper *El Clarín* headlined "What began as a reflection of the Mexican crisis is now a shake-up with a dynamic of its own". On the same day, the Argentina's Minister of Economy had the first meeting with investors in New York. His sole purpose was reassuring them and, thus, trying to prevent international funding from drying up. In parallel, a similar fate befell Brazil, Chile, Peru, Venezuela. These subsequent crises have been explained by a kind of demonstration effect, based on the widespread fear about the performance of emerging markets (Arancibia and Ramírez, 1995). Effectively, according to Dornbusch, Goldfajn and Valdés (1995), during those crises, it was not the policy that was wrong, but the accidental interference with short-term financing. This interpretation is captured by the notion of sudden stop.

Inspired by the adage “it is not speed that kills, but the sudden stop”, the work of Dornbusch, Goldfajn and Valdés (1995) proposes the use of the term for the first time. However, it was not until 1998 that Guillermo Calvo, in *The Simple Economics of Sudden Stops*, inaugurated the systematic study of this concept. By then, the crisis in Southeast Asia also corroborated its usefulness. In July 1997, a crisis originated in Thailand initiated a sequence of financial disturbances in the Philippines, Indonesia, Korea and Malaysia. In all these cases, the common denominator was an abrupt cut-off of international funding sources (Chudnovsky, López and Pupato, 2003). From then on, the study of sudden stops has gained more and more attention. For example, August 1998 saw the so-called Russian crisis. Once again, factors apparently unrelated to the policies of emerging countries produced an abrupt interruption in capital inflows, causing strong output contractions (Calvo, 2001).

The main challenge of sudden stops is the adjustment mechanism. A cutback in access to international capitals entails a forced adjustment in the current account of the balance of payments (BOP), from deficit to surplus, or at least to a point of equilibrium. Usually, this

adjustment occurs trough a sizable depreciation of the Real Exchange Rate (RER), whether to promote exports or contract imports. For example, Guidotti, Sturzenegger, and Villar (2004) studied adjustment mechanisms due to sudden stops occurring during the 1990's. They found evidence that Asian countries made an adjustment by stimulating exports, while Latin American countries did so by reducing imports. The reason why a country undertakes one type of adjustment or another is not only a matter of choices, but of pre-existing factors prior to the shock. These issues will be discussed further in the next section.

In its genesis, the concept of sudden stop was thought particularly to understand those financial crises in emerging markets. The idea that a BOP crisis could be caused mainly by international capital markets rather than by domestic factors was quite novel at the time. The trigger of those crises was based on supply shocks stemming from world capital markets rather than on domestic policy failings (Cavallo, 2019). Thus, investors behaviour became increasingly explanatory. During the aforementioned crises, specific events in one country had contagion effects in other countries through the behaviour of investors, who were able to limit the availability of international financing (Chudnovsky, López and Pupato, 2003).

Therefore, a sudden stop in capital flows occur when foreign financing available to borrower countries unexpectedly dries up; this occurred regardless of the underlying macroeconomic fundamentals of the recipient countries (Cavallo, 2019). Empirically, Calvo, Izquierdo y Mejía (2004) proposed an algorithm to define sudden stops that has been widely accepted in the literature. According to them, a sudden stop phase starts with a fall in capital flows below one historical standard deviation, followed by a fall of two standard deviations, and lasts until capital flows rise back above one standard deviation (see Chapter II). This definition is the basis on which most of the literature has identified sudden stop episodes, including this thesis.

1.2. The first generation of sudden stop analysis

Although evidence of sudden stops has been found since the late 1970s, it was not until the second half of the 1990s that a systematic study of these events began. From then until the global financial crisis (GFC) of 2007-2009, a first generation of research could be defined. During this period, the main reflections revolved around how to deal with sudden stops. Thus, analytical foundations in this field were laid. An additional feature of this generation is that it is mainly focused on emerging markets, something that will change after the GFC.

Since the beginning of this century, therefore, the bulk of the literature has been devoted to identifying the causes of these shocks. Certainly, by definition, sudden stops are triggered by unexpected factors, linked to financial and external origins. However, there are some domestic conditions that could increase the likelihood of sudden stop to happen, as well as to amplify its effects (Calvo, Izquiero and Mejía, 2004). In that sense, the first debate was about the role of the fiscal stance. On the one hand, there was the Fiscal View, which argued

that large fiscal deficits eventually lead to an unsustainable level of public debt, so there comes a time when lenders stop lending. On the other hand, the Inverse Fiscal View counter-argued that empirical evidence suggests that sudden stop episodes tend to occur around the same time, and for countries exhibiting a variety of fiscal situations. As it will be seen later, although the Fiscal View is right, it is not the most important one.

After the debate on the Fiscal View, Calvo, Izquierdo and Talvi (2004 and 2006) conclude that sudden stops are likely to be the result of systemic capital market forces interacting with domestic financial vulnerabilities. Firstly, according to them, the most important domestic factor is the current account deficit (CAD). Intuitively, capital inflows are used to finance the CAD. That means that the greater the deficit, the greater the adjustment in the event of a sudden stop. As mentioned above, the CAD adjustment could be stimulated by a devaluation of the RER, which may or may not be the result of a nominal devaluation. In any case, the authors suggests that such devaluation could generate a drop in the aggregate demand too. Secondly, another domestic factor is a high level of Domestic Liability Dollarization (DLD), i.e., a high incidence of foreign-exchange denominated obligations. In economies with high DLD, large RER devaluations are likely to be associated with financial turmoil, especially in non-tradable sectors, given an unsustainable increase in the level of debts. Thirdly, the fiscal deficit indeed can exacerbate vulnerabilities to sudden stops. The reason, as mentioned above, has to do with the eventual loss of access to credit markets, due to the risk of default.

Derived from the literature on the determinants of sudden stops, an extensive line of research has emerged on possible policy measures to reduce their likelihood or to minimise their effects. These measures can be divided into three groups: structural, fiscal and monetary measures. The first have to do with the negative effects of trade openness on the probability of a sudden stop (Cavallo and Frankel, 2004). There are some mechanisms that could explain this inverse relation. For instance, the threat of losing trade motivates countries to meet their credit obligations. Then, investors are less likely to pull out of a country with a high trade/GDP ratio (Frankel and Rose, 2002). Another mechanism has to do with the fact that more open countries tend to cope with a sudden stop by stimulating exports rather than contracting imports and aggregate demand (Guidotti, Sturzenegger and Villar, 2004). From a financial perspective, in case of high DLD, a RER devaluation could affect tradable sectors (exporters) to a lesser extent, so a high share of them in the economy could reduce the overall risk of accounting imbalances in the private sector (Calvo, Izquierdo and Talvi, 2004).

In terms of fiscal policy, the suggestion is along the lines of having an intertemporal fiscal sustainability and fiscal credibility (Guidotti, 2007; Alberola, Kataryniuk, Melguizo and Orozco, 2017). In fact, Gómez-González, Valencia and Sánchez (2021) found that the implementation of Fiscal Rules significantly decreases the likelihood of sudden stop. In the area of monetary policy, the recommendations are basically two: flexible exchange rate and high levels of precautionary international reserves (Guidotti, Sturzenegger and Villar, 2004;

Catão, 2007; Calvo, Izquierdo and Loo-Kung, 2012). On one hand, flexible exchange rate allows the adjustment mechanism to operate in case of a forced current account reversal. On the other hand, international reserves have good hedging properties. In the event of a sudden stop, reserves could partly finance the CAD, offsetting potential balance-sheet effects stemming from high DLD. It is important to reiterate that fiscal and monetary measures are suggested as preconditions to cope with an eventual sudden stop. These measures could reduce its probability of occurrence or provide better conditions for dealing with it. However, once the sudden stop materializes, the new challenge is to address the lack of funding. That is why Ortiz, Ottonello, Sturzenegger, and Talvi (2009) found that, countries that were able or willing to loosen monetary and fiscal policy fared better than those that did not.

In summary, two questions have dominated this first generation of research: what causes a sudden stop and how to avoid or cope with it. However, to some extent, there is a question that seems to be understudied so far: what are the economic consequences of sudden stops.

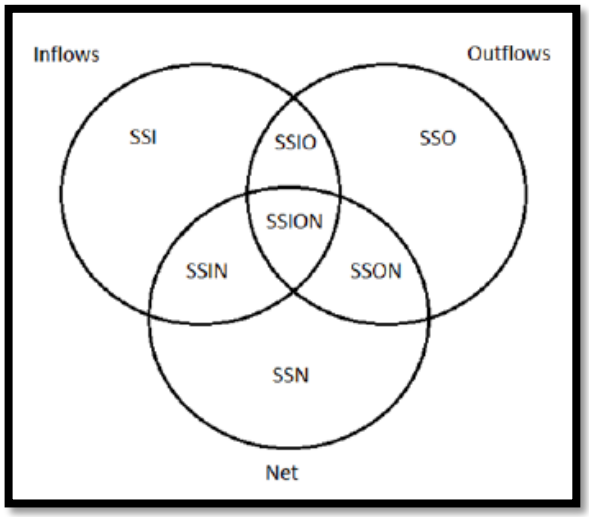
1.3. The second generation of sudden stop analysis

Since the GFC of 2007 and 2009, a renewed interest in sudden stops has emerged. It is possible to define a new generation of research characterized by three elements. First, an extension of the analysis towards developed economies. The GFC demonstrated that sudden stops could also occur in advanced economies. Second, a deeper analysis of the gross inflows and outflows in the determination of net flows. This evolution can be explained by the fact that, after GFC, net capital flows have become more volatile in advanced economies, whereas gross capital flows have grown in magnitude in emerging markets (Cavallo, 2019). Third, an increasing attention on the consequences of sudden stops. As early as 2004, but again in 2008, Calvo, Izquierdo and Mejía pointed out the lack of studies about consequences of sudden stops on economic growth. This gap in the literature is not entirely true, as there are some preliminary studies (see Edwards, 2004; Guidotti, et al., 2004), but it is certainly after the GFC when this line of research becomes more relevant. It should be noted that these three elements rather complement the previous topics, not necessarily replace them.

The works of Forbes and Warnock (2012) accurately illustrate this new strand of literature. They apply the algorithm of Calvo, Izquierdo y Mejía (2004) to identify shocks in gross inflows and outflows. They focus now on the behaviour of foreign and domestic investors separately, which allows them to study what they name extreme movements in international capital flows. They create four categories of such extreme movements: *stops* (when foreign capital decreases), *surges* (when foreign capital increases), *flights* (when domestic capital is sent abroad) and *retrenchments* (when domestic capital re-enters). As can be inferred, their focus is not placed only on sudden stops. Forbes and Warnock seek to identify the systemic determinants of these extreme capital movements at global level. However, their contribution to the subject lies in the use of the Financial Account of the BOP to study gross capital flows.

Forbes and Warnock (2012) approach will be taken up later to specifically study sudden stops. Indeed, the work of Cavallo, Powell, Pedemonte and Tavella (2013) departs from this new focus on gross and net flows, in order to study sudden stops. Their aim is to design a new taxonomy of sudden stops, based on the behaviour of net and gross flows, that comprises seven categories, as shown in the figure 1.1.

Figure 1.1. Taxonomy of sudden stops



SSI	A sudden stop in inflows that does not imply a sudden stop in net flows;
SSO	A surge in outflows that that does not imply a sudden stop in net flows;
SSN	A sudden stop in net flows that does not imply a sudden stop in inflows nor outflows;
SSIN	A sudden stop in inflows that implies sudden stop in net flows;
SSON	A sudden surge in outflows that implies a sudden stop in net flows;
SSION	A sudden stop in inflows and a sudden surge in outflows, which together imply a sudden stop in net flows; and
SSIO	A sudden stop in inflows and a sudden surge in outflows, that do not imply a sudden stop in net flows (although theoretically a possibility, it has never happened).

Source: Cavallo, Powell, Pedemonte and Tavella (2013).

This new typology of sudden stops has allowed, for instance, to better understand why the effects of the GFC are different from those of the previous decades. Cavallo, Izquierdo and León (2017) found that in periods of global crisis, total gross capital flows collapse due to the retrenchment from foreign markets everywhere. This is what is behind the observation that during the GFC, large capital flows retrenchments compensated the fall in gross capital inflows. Following this line of thought, Cavallo, Izquierdo and Leon (2020) introduced a new notion of "prevented sudden stop". Basically, it means a situation in which gross outflows move in the opposite direction to gross inflows so that net capital flows remain relatively stable, meaning that net capital flows do not enter into sudden stop mode.

The work of Hwang, Jeong, Park, and Park (2017) brings back the focus on net capital flows. However, they look at gross flows to classify whether extreme movements in net flows are driven by inflows or outflows. In terms of sudden stops, they only identify those events that occurs in net flows and, subsequently, classify them as *stops* and *flights*. Then, if the net sudden stop is associated with a larger drop in inflows, it is a stop; conversely, if the dominant flow is the gross outflow, then it is a flight. Certainly, this method allows to classify net sudden stops even if they are driven by mild movements in gross flows (SSN). Hwang et. al. (2017) do not need to identify sudden stops in gross flows. They only look at which of the gross flows shows a greater drop. In that sense, the typology of Cavallo et al. (2013) present a shortcoming, since they cannot know what gross flow actually drives a SSN episode. However, since Hwang et al. (2017) overlook sudden stops in gross flows, their method does not allow differentiating a SSIN or SSON from a SSION, which also is a shortcoming.

To detect which flow is dominant only takes looking within each episode (SSN or SSION) to identify the magnitude of the gross flows. Then, both shortcoming are somehow easily remediable. However, for the purposes of this thesis, the real drawback with the Hwang et al. (2017) methodology is that it does not consider extreme movements in gross flows, which leaves out SSI episodes. Therefore, the typology proposed by Cavallo et al. (2013) remains more comprehensive, as it keeps a deep insight into the formation of net sudden stops, but also includes the analysis of sudden stops in gross flows.

In summary, this second generation brings two major innovations to the sudden stop literature. First, it incorporates developed economies as new case studies. Second, it includes gross flows as new analytical tools. Besides, there were also important advances on the effects of sudden stops on GDP.

1.4. Sudden stops and economic growth

In general terms, literature has overlooked the relationship between sudden stops and economic growth. However, there are some precursor studies that have partially addressed this relationship at least since 2004.

One of the first works to study this relationship is that of Edwards (2004). Essentially, the author study the effect of current account reversals, which may or may not be associated to sudden stops. Here, the author questions what is the cost, in terms of GDP growth, of current account deficit reversals. Such reversal is defined as a reduction of the CAD equivalent to 4% of GDP over a one-year period. The study covers 157 countries, from 1970 to 2001, but not all of them record the same data for the entire period. They use annual data from the World Bank. Certainly, the author is interested in the connection between CAD reversals and sudden stops. That is why the paper also identifies sudden stops episodes.

Congruent with the first generation of research, Edwards (2004) focuses on sudden stops in net capital flows. However, in this work, sudden stops means an annual fall of net flows equivalent at least to 5% of the country's GDP. The author found that 46% of all net sudden stops caused a current account reversal. Consequently, the results must be carefully read. The study estimates the effects of CAD reversal on real GDP growth, not necessarily the effects of sudden stops. Having said that, to estimate such effect, the author uses a "treatment effects" model, in which he regresses, on the variable of interest, a dummy variable (CAD reversal) and other conditional variables. Finally, he estimates the effect on real GDP growth in around -4%, which can be worse in case of low trade openness and non-flexible exchange regime. According to the research, less open countries will have to make a greater effort, in terms of reducing aggregate demand, when adjusting the trade balance. Moreover, countries with a flexible exchange rate regime are able to accommodate better external shocks, including terms of trade. To summarize, the work of Edwards (2004) addresses the effect of CAD reversals on GDP growth, which can be explained by the occurrence of sudden stops. That is why this thesis considered this work as one of the precursors to study the relationship between sudden stops and GDP. However, it is only a first approach to our subject of interest.

The work of Guidotti, Sturzenegger, and Villar (2004) wonder why countries react differently to sudden stops, in terms of economic growth. In this research, authors do use the empirical definition of Calvo, Izquierdo and Mejía (2004) to identify sudden stops in net flows. They use annual data, from 1974 to 2003, covering all countries for which data were available. The exact number of countries is undisclosed, but they report around 3500 country-year observations. The methodology is dynamic and considers a horizon of three periods (years). Their variable of interest is the growth rate over the next three years after a sudden stop. However, it is important to clarify that they do not estimate the direct effect of the sudden stop on growth, but the effect of related variables (i.e. trade openness and exchange regime) on growth in the aftermath of a sudden stop. Thus, their results show, for example, that countries with high trade openness and floating regimes grow more during the next three years after a sudden stop (up to 5% more) versus those with low trade openness and rigid exchange regime. So, while the use of the dynamic model is an innovative contribution, the direct effect of the sudden stop on growth is still an open question.

An important contribution can be found some years later, effectively, in Cavallo, Powell, Pedemonte and Tavella (2013). Unlike the two previous studies, this research use quarterly data from the IMF. Their database covers 63 countries, from 1980 to 2010. Before them, the study of sudden stops focused only on net flows. They uncovered the heterogeneity amongst the different types of sudden stops, not only by looking at the gross flows, but also at their interaction with the net flows. This allowed them to create the new typology of sudden stops that thesis uses. They also estimate the effect of each type on economic growth, to estimate which one is costlier. To do so, they implement a simple regression analysis on real GDP to estimate the effect of such event (dummy variable), controlled by the trend of GDP.

Cavallo, et.al. (2013) conclude that stops in net flows remain the most costly, because they imply adjustment. Sudden stops in gross flows also appear to have disruptive effects, as they can be destabilising. In fact, according to this analysis, SSI episodes are even costlier than SSN episodes. Moreover, as introduced above, this research confirms that sudden stops driven by inflows are more detrimental than those driven by outflows. They claim that the effects of outflows-driven shocks on GDP are practically nil. While these conclusions are ground-breaking, it is still possible to research more about the effects on GDP. For example, the use of new methodologies could contribute to the understanding the dynamic effects of sudden stops, as it is so far unknown how long it takes to adjust to such a shock.

Precisely, Hwang, Jeong, Park, and Park (2017) aim to contribute to the relation between sudden stops and GDP growth by using a dynamic approach (panel vector autoregressive, PVAR). They also use quarterly data from 1980 to 2008, from IMF. It should be noted that they only focus on net flows. Yet, even if they decide to step back to focus only on net flows, their dynamic methodology makes substantial contributions. For example, they conclude that inflow-driven net sudden stops negatively affect GDP growth, and this effect is perceived mainly one quarter after the start of the shock. In case of outflows-driven net sudden stops, they have no significant effect on growth, either in the short or medium term. It is inevitable to wonder whether these conclusions hold in case of gross sudden stops. Moreover, even if this work shows the effect of sudden stop over time, it is not possible to know the absorption time of the shock, since it does not consider its cumulative effect.

The relationship between sudden stops and economic growth is perhaps the most recent field of study on sudden stops. This is not to say that it is an unexplored line of research, as shown above. In fact, these studies allow us to conclude that inflow-driven sudden stops, both in gross and net flows, present a serious threat to economic growth. However, according to the scope of this literature review, no analysis has been developed so far that, using a dynamic approach, studies both net and gross flows to analyse the effect on economic growth. For these reasons, this thesis aims to analyse the dynamic effect of two types of sudden stops that have proven to have detrimental consequences on GDP. They are SSI and SSIN, which are going to be our main independent variables. Therefore, next chapter presents how are sudden stops identified and classified, as well as the main trends during the last three decades. This will definitely allow for a better understanding of what inflows-driven sudden stops are and how they differ from other types of sudden stops.

Chapter II. IDENTIFICATION, CLASSIFICATION AND ANALYSIS OF SUDDEN STOPS
A revised typology

The objective of this chapter is to identify, classify and examine the main trends of sudden stops during the last three decades. To this end, the thesis replicates the typology proposed by Cavallo, Powell, Pedemonte and Tavella (2013). However, a reclassification of the SSN episodes is incorporated, so that it is possible to know in greater detail their composition. Therefore, the first section of this chapter addresses methodological concerns, as well as some key definitions. Then, the chapter incorporates two more sections to present the results of the typology and to explore the main trends in sudden stops, respectively.

2.1. Methodology

Certainly, a sudden stop in net flows could occur as a result of a decrease in capital coming from abroad, an increase in capital going abroad, or a combination of both. In other words, to understand the formation of a sudden stop it is necessary to analyse the sum of gross inflows (non-resident flows) and gross outflows (resident flows). This information can be taken from each country's Balance of Payments (BOP) financial account. The BOP is a statistical statement that summarizes transactions between residents and non-residents during a given period. The financial account is one of the components of the BOP and shows specifically the net acquisition of financial assets and net incurrence of liabilities (IMF, 2009). This analysis uses data available in the International Financial Statistics (IFS) dataset, by the International Monetary Fund (IMF). The period of analysis has been defined from 1990, when the study of sudden stops started, to the most up-to-date data in 2021. It should be noted that the time series starts in 1985. As will be seen below, to identify sudden stops in the early 1990's, it is necessary to have a basis for estimating historical means and standard deviations. Thus, our time series starts five years before the beginning of our analysis period.

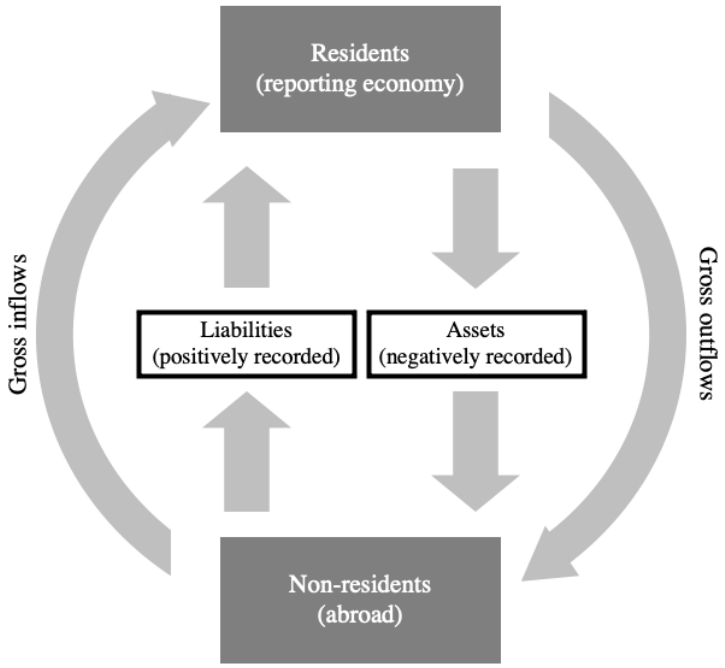
Table 2.1 Balance of Payments (BOP) subcomponents

Balance of Payments (BOP)		
Current account	Capital account	Financial account
Goods and services	Nonfinancial assets	• Direct investment • Portfolio investment • Other investment (for instance, foreign bank's loans and deposits)

Source: Own elaboration, based on IMF, 2010.

On the one hand, *gross financial inflows* are defined as the changes in the stock of foreign liabilities owed by residents. As table 2.1 shows, they are comprised of direct investment receipts, portfolio investment liabilities and other investments liabilities. Said differently, gross inflows can be considered as the change in the position of liabilities by residents that constitute assets for non-residents. Thus, an increase in liabilities is positively recorded in the BOP, as it implies an inflow of money. On the other hand, *gross financial outflows* are changes in the stock of foreign assets held by residents. Accordingly, they are comprised of direct investment abroad, portfolio investment assets and other investments assets. Likewise, gross outflows can be considered as changes in the holding position of foreign assets by residents. Thus, an increase in foreign assets is negatively recorded in the BOP, as it implies an outflow of money. Consequently, net flows are the sum of gross inflows and gross outflows, i.e. the financial account of the BOP.

Figure 2.1. Gross flows



To compute each gross flow, all their subcomponents are summed. According to IFS dataset, in case of gross inflows, they are: current account credit (CAC), direct investment in the reporting country (DIR), other investment liabilities (OIL) and portfolio investment liabilities (PIL). In case of gross outflows, they are: current account debit (CADe), direct investment abroad (DIA), other investment in assets (OIA), and portfolio investment in assets (PIA). As mentioned above, net flows are the result of summing both gross flows. It is important to notice that, as all series are in quarterly data, gross inflows, gross outflows and net flows are annualized to avoid seasonality effects. Specifically, the equation used is the following:

$$C_{t,j} = \sum_{i=0}^{3} X_{t-i,j} \tag{2.1}$$

where *j* can take three different values: gross inflows, gross outflows or net flows. Next, the annual variation of each of the series is calculated using the following equation:

$$\Delta C_{t,j} = C_t - C_{t-4} \tag{2.2}$$

where *t* starts from 5, 6, 7, … to *T*.

Subsequently, rolling means and standard deviations of $\Delta C_{t,j}$ are computed over the last twenty quarters. It should be noted that only countries with at least 40 quarters of consecutive data are kept. Then, the analysis includes information on 124 countries; according to the United Nations, 37 are developed economies, 71 are developing economies, and 16 are transition economies. This results in about 12800 country-year-quarter observations. Now, in case of Norway (1992 and 1993) and Laos (2000), there is a gap in quarterly data but complete annual data. Following Warnock and Forbes (2021), only for those countries and only for those years, annual data are converted to quarterly data by simply dividing by four.

In order to identify sudden stops, the algorithm of Calvo, Izquierdo and Mejía (2004) is implemented. Thus, a sudden stop phase meets the following conditions. Firstly, the time series contains at least one observation where the year-on-year fall in flows is at least two standard deviations below its sample mean (the "unexpected" characteristic of sudden stops). Secondly, the sudden stop phase ends once the annual change in flows exceeds one standard deviation below its sample mean. This will generally introduce persistence of sudden stops. Thirdly, for the sake of symmetry, the start of a sudden stop phase is determined by the first time the annual change in flows falls one standard deviation below the mean.

From an operational point of view, we first calculated the historical (five-year) means and standard deviations on a rolling basis (Warnock and Forbes, 2012). Then the method consists of identifying all annual variations ($\Delta C_{t,j}$) below two historical standard deviations. Any value meeting this condition confirms the presence of at least one episode. Then, for each value falling below two standard deviations, it is necessary to identify all the values that consecutively to that value fall at least one standard deviation, both backwards and forwards, so that we can identify the beginning and the end of the episode, respectively. This algorithm has been applied to gross and net flows. The case of Argentina illustrates how this algorithm works (Figures 2.2, 2.3, 2.4).

Figure 2.2. Sudden stops in inflows - Argentina
(millions of USD)

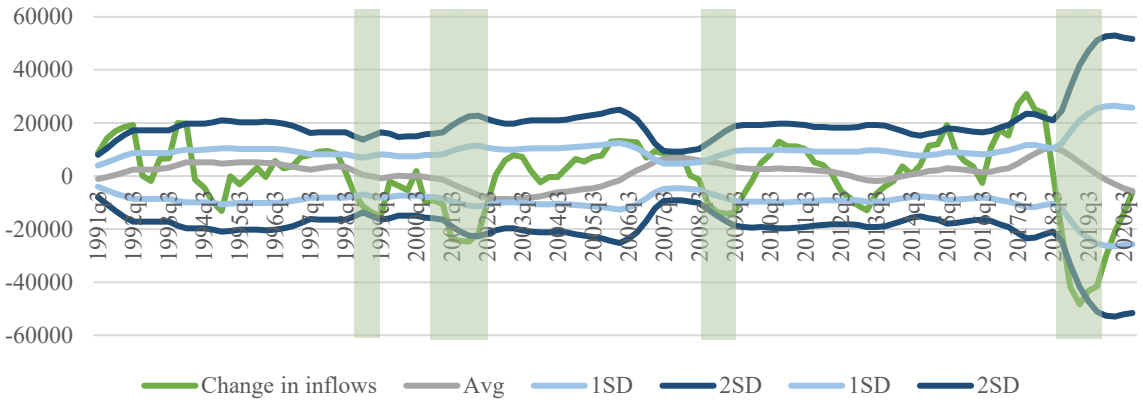


Figure 2.3. Sudden surge in outflows - Argentina
(millions of USD)

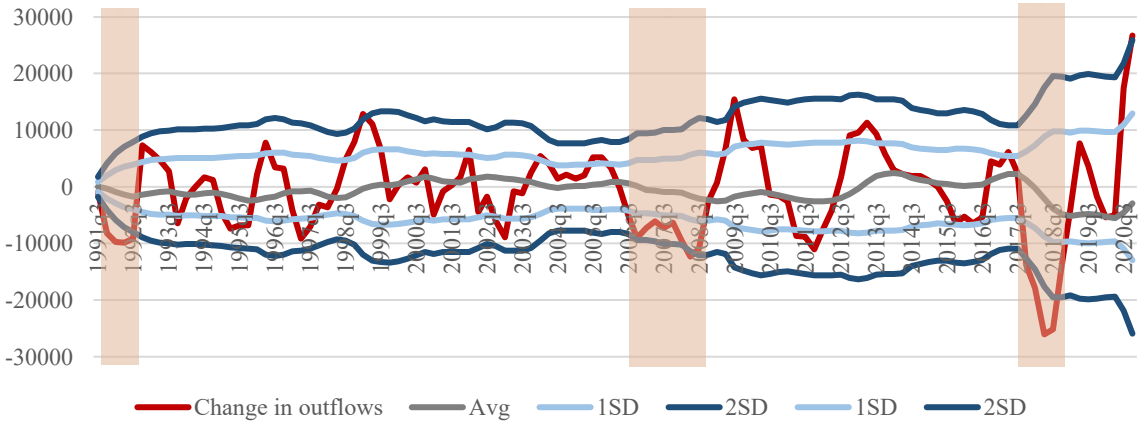
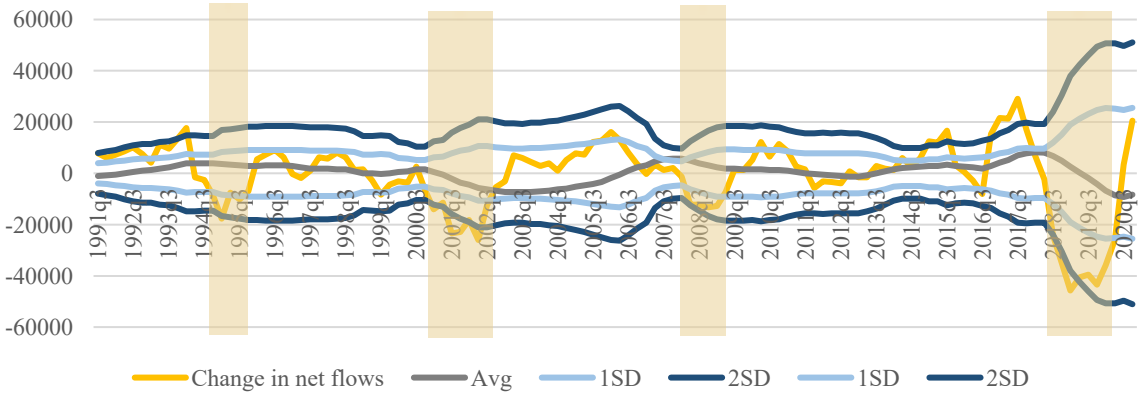


Figure 2.4. Sudden stops in net flows - Argentina
(millions of USD)



2.2. Identification and classification of sudden stops

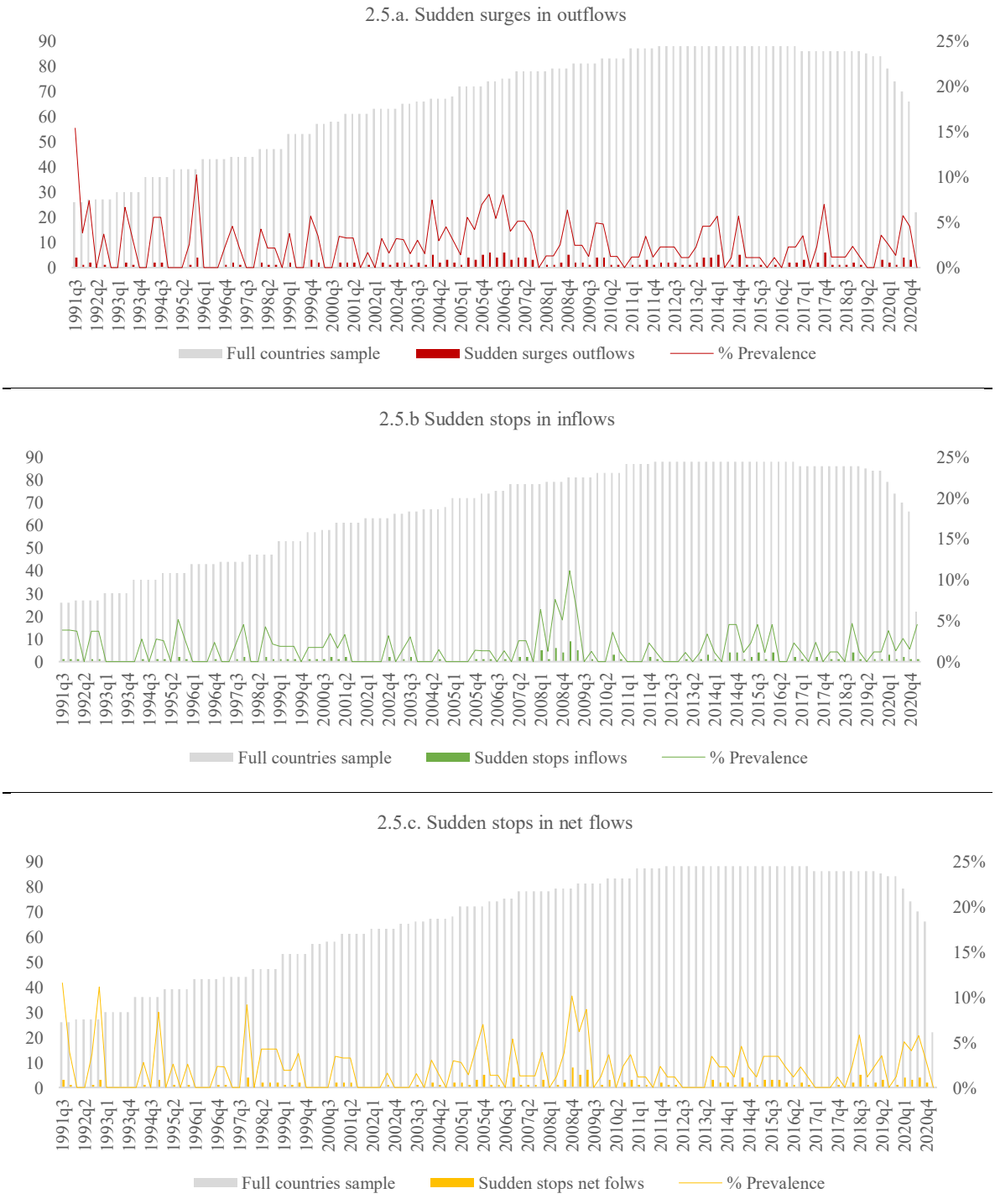
Once the described algorithm is applied to quarterly flows data, it is possible to compute 210 sudden stops in inflows, 327 sudden surges in outflows and 240 sudden stops in net flows. Surges in outflows appear to be not only more frequent than stops in inflows, but also longer lasting. On average, these episodes have a duration of about one year. Regarding the difference between countries, it can easily be said that the developed economies tend to face longer events in gross flows, but not in net flows. However, speaking about prevalence, it is not so easy to draw some conclusions. Although the absolute number of events is higher in developing economies, when the ratio is calculated, it appears that developed economies experience this type of event more frequently, as can be seen in figures 2.5 and 2.6. The problem, however, has to do with the availability of data, since there is not the same data for all countries in all periods (Annex 1).

Table 2.2. Episodes in developed, developing and transition economies (1990-2021)

	All countries		***Developed economies***		***Developing and transition economies***	
	Frequency	Average duration in quarters	Frequency	Average duration in quarters	Frequency	Average duration in quarters
Stops in inflows	210	3.6	81	3.8	129	3.5
Surges in outflows	327	4.0	122	4.1	205	4.0
Stops in net flows	240	3.6	77	3.6	163	3.6

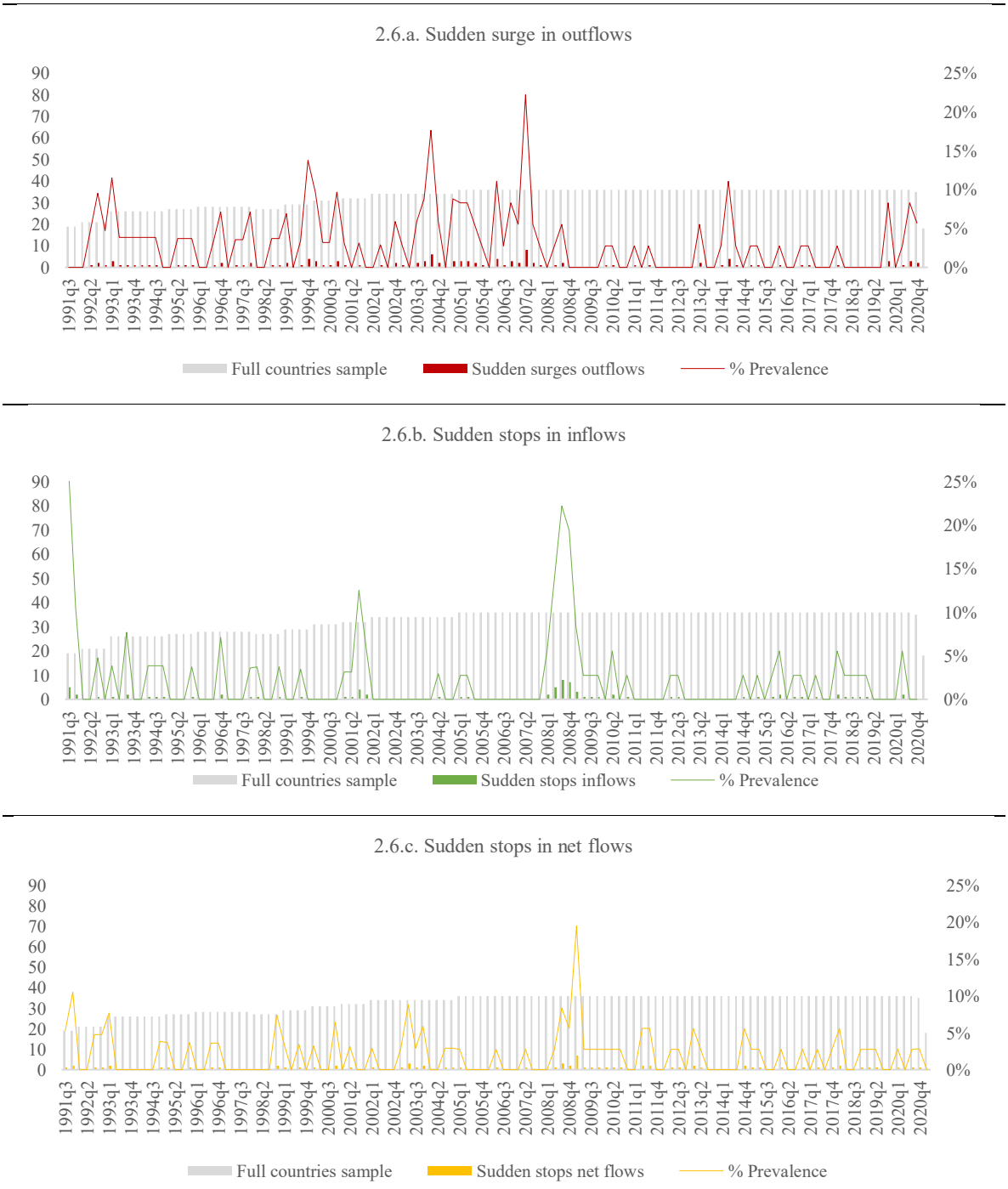
Figures 2.5 and 2.6 show the frequency of these events in developing and developed economies, respectively. These figures take into account the data availability for each quarter, so that it is possible to draw more realistic conclusions about the prevalence of sudden stops. For instance, developing economies have less information available during the earlier years, making it more difficult to estimate the actual number of episodes that have occurred. For example, considering figure 2.5.b, in 1991q3, only 26 developing economies fully reported their financial account, while, in 2012q1, 88 did so. That results in the fact that the only sudden stop in gross inflows identified in each quarter represents a prevalence of around 4% and 1%, respectively. In contrast, developed economies tend to record information more systematically and are in the minority. This facilitates the identification of events, which could result in more events per number of countries.

Figure 2.5. Frequency and prevalence of episodes in developing and transition economies (1990-2021)



Note: Prevalence is the result of dividing the number of episodes in one quarter by the total number of countries for which there is information in the same quarter.

Figure 2.6. Frequency and prevalence of episodes in developed economies (1990-2021)



Note: Prevalence is the result of dividing the number of episodes in one quarter by the total number of countries for which there is information in the same quarter.

However, the identification of extreme movements in gross inflows and outflows alone do not provide conclusive information. As noted before, these extreme movements in capital

flows could probably be the result of deep integration in the international financial market, rather than a negative shock to the economy. Therefore, the main value of this information is its use for further analysis on a wider disaggregation of the concept of sudden stops. .

Following Cavallo, et. al. (2013), gross flows and net flows are crossed to define the seven types of sudden stops. Table 2.3 illustrates how these types are defined. Furthermore, according to the authors, one additional adjustment was made. When sudden stops in gross outflows (SSO) are accompanied by an increase in net flows, they are left aside. The reason is that an increase in outflows coinciding with an increase in net flows could be the result of excess capital in the economy, so investors look to other markets to diversify their investments. Finally, to avoid duplication, when episodes are simultaneous only in some quarters, the quarters in which the concurrent episodes occur are privileged, and the rest are not considered. In that sense, SSION are preferred to SSIN, SSON and SSIO, and these three types of episodes are preferred to SSI, SSO and SSN (see Table 2.4).

Table 2.3. Definition of the each type of sudden stop

Episode	Sudden stop in inflows	Sudden surge in outflows	Sudden stop in net flows
SSI	1	0	0
SSO	0	1	0
SSN	0	0	1
SSIN	1	0	1
SSON	0	1	1
SSION	1	1	1
SSIO	1	1	0

Table 2.4. Simultaneous episodes only in some quarters

Quarters	Sudden stop in inflows	Sudden surge in outflows	Sudden stop in net flows	Episode
Q1	1	0	0	~~SSI~~
Q2	1	0	1	~~SSIN~~
Q3	**1**	**1**	**1**	**SSION**
Q4	**1**	**1**	**1**	**SSION**
Q1	0	1	1	~~SSON~~
Q2	0	1	0	~~SSO~~
Q3	0	0	0	

As innovation, this thesis incorporates a re-classification of sudden stops in net flows only (SSN). Based on Hwang, Jeong, Park and Park (2017), if the annual fall in inflows is larger than the annual fall in outflows, the SSN episode is classified as inflow-driven (SSNi); otherwise, it is classified as outflow-driven (SSNo). Therefore, SSNi and SSNo are sudden stops in net flows, which do not imply neither a sudden stop in inflows nor a sudden surge in outflows. Yet, this re-classification allows to identify which is the dominant flow. Having said that, table 2.5 shows all the identified sudden stops from the whole sample.

Table 2.5. Sudden stops (1990-2021)

	All countries		Developed economies		Developing and transition economies	
Type	Frequency	Average duration in quarters	Frequency	Average duration in quarters	Frequency	Average duration in quarters
SSI	99	3.4	51	3.7	48	3.0
SSO	192	3.5	73	3.5	119	3.5
SSN	70	2.8	30	2.9	40	2.7
• **SSNi**	36	2.7	14	2.6	22	2.7
• **SSNo**	34	2.9	16	3.1	18	2.7
SSIN	90	2.7	29	3.0	61	3.2
SSON	64	3.1	20	2.3	44	2.8
SSION	21	1.7	2	1.5	19	1.7
SSIO	0	0	0	0	0	0

Figure 2.7. Number of sudden stops in developing and transition economies (1990-2021)

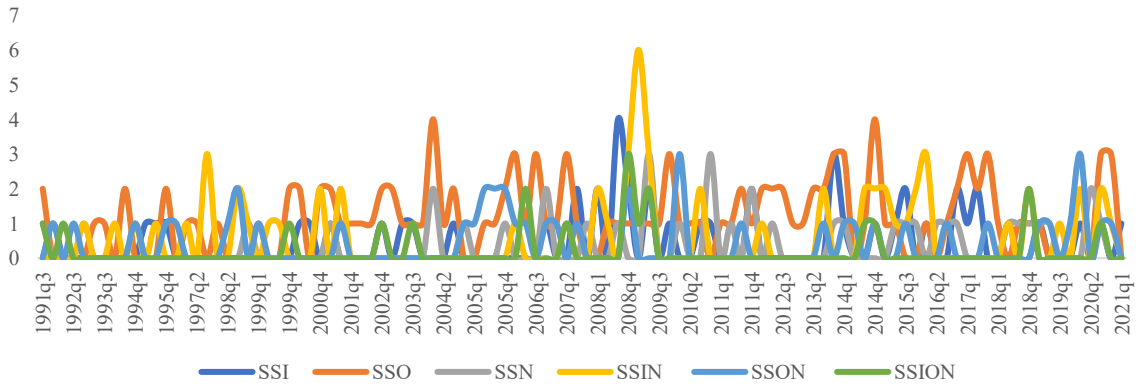
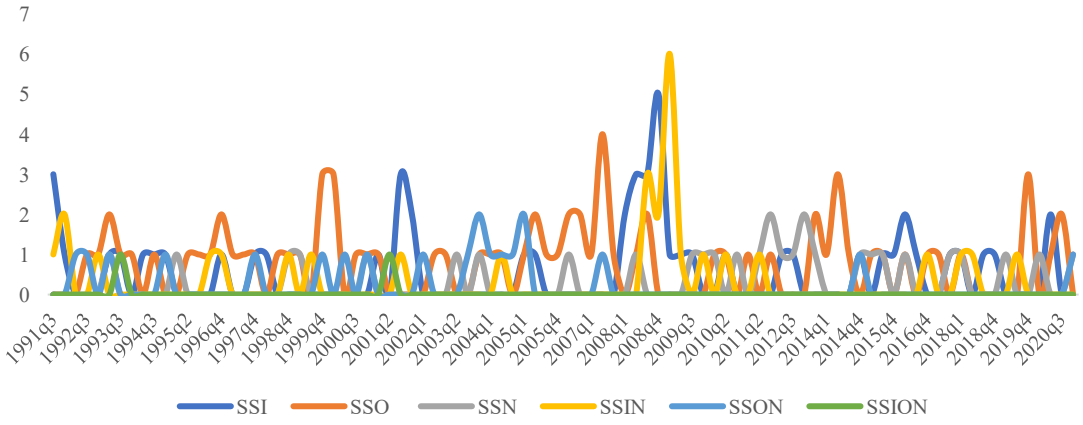


Figure 2.8. Number of sudden stops in developed economies (1990-2021)



2.3. Analysis of sudden stop trends

The analysis of sudden stops by decades illustrates a number of facts worth noting. The most evident perhaps is the fact that these kinds of extreme movements in financial flows increase over time. While in the 1990s about 100 events were recorded, the following two decades have more than doubled that number of events. This may be a reflection not only of the availability of data, but also of the increasing integration of international capital markets, especially in the so-called era of globalization (post-1990s). Effectively, a remark that emerges from the analysis of figure 2.9 is the radical increase in gross outflows (SSO) in the 2000's and the 2010's. This supports the idea that more and more countries are exporting an increasing amount of capital as a result of greater financial integration at global level.

Figure 2.9. Number of sudden stops by type and decade (All countries)

In terms of the difference between developed and developing countries, the most notable feature is the predominance of stops in net flows among developing countries. During the entire period, of all the events identified in developing countries, 50% corresponded to sudden stops subtypes in net flows (SSIN, SSON, SSN, SSION). That proportion decreases at 40%, in case of developed countries. The difference is even more notorious during the 1990's. In that decade, 62% of all events in developing economies implied sudden stops in net flows, while in developed economies that percentage was only 37%. Later, during the 2000's and the 2010's, that difference is attenuated, but it keeps the same relation: 46% *vs*. 40% and 49% *vs*. 41%, in developing and developed economies, respectively. That explains why, during the genesis of studies on sudden stops, these events were considered not only as shock in net flows, but as problem mainly faced by developing countries (Calvo, 1998).

Figure 2.10. Number of sudden stops by type and decade
(Developing and transition economies)

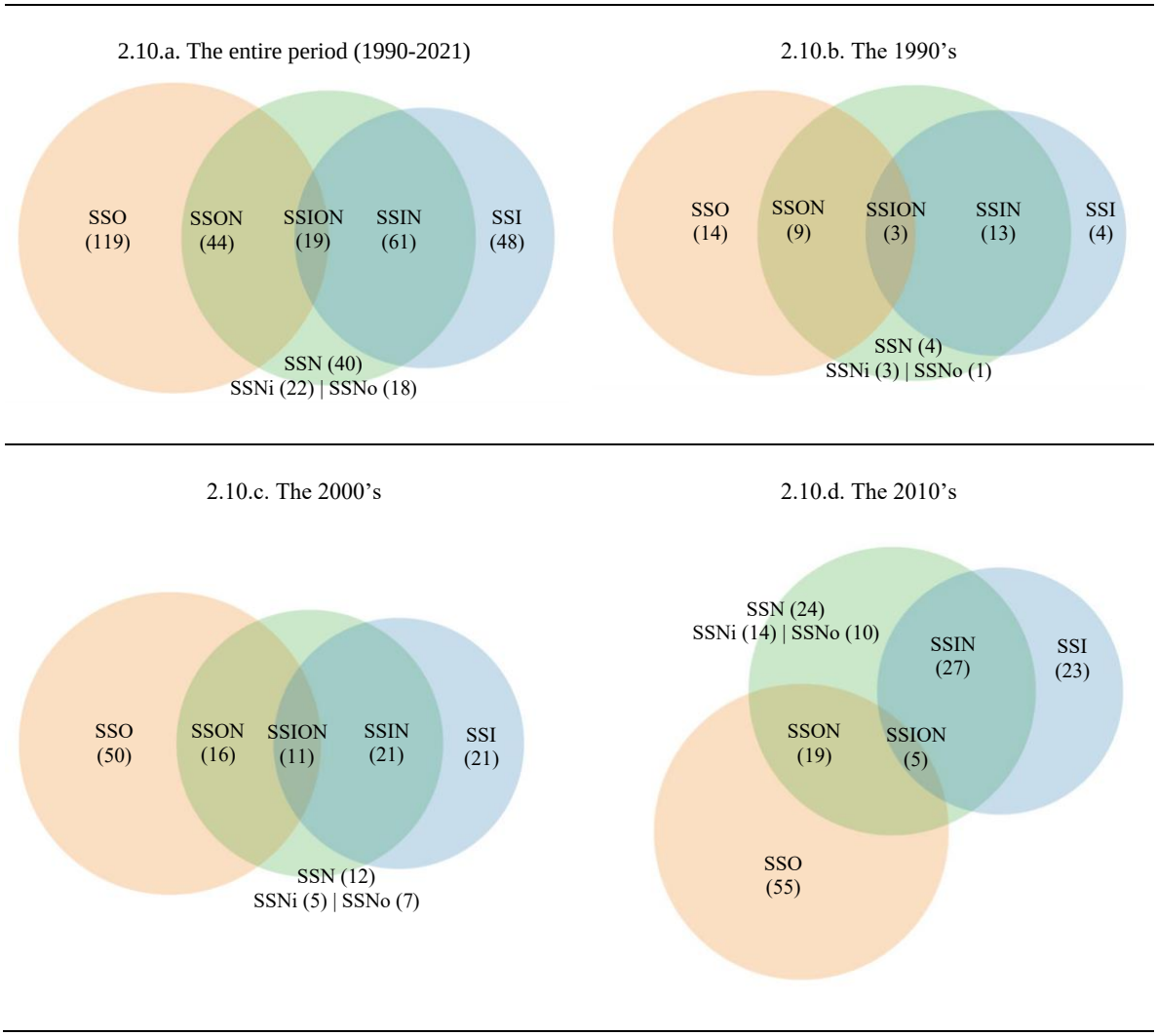
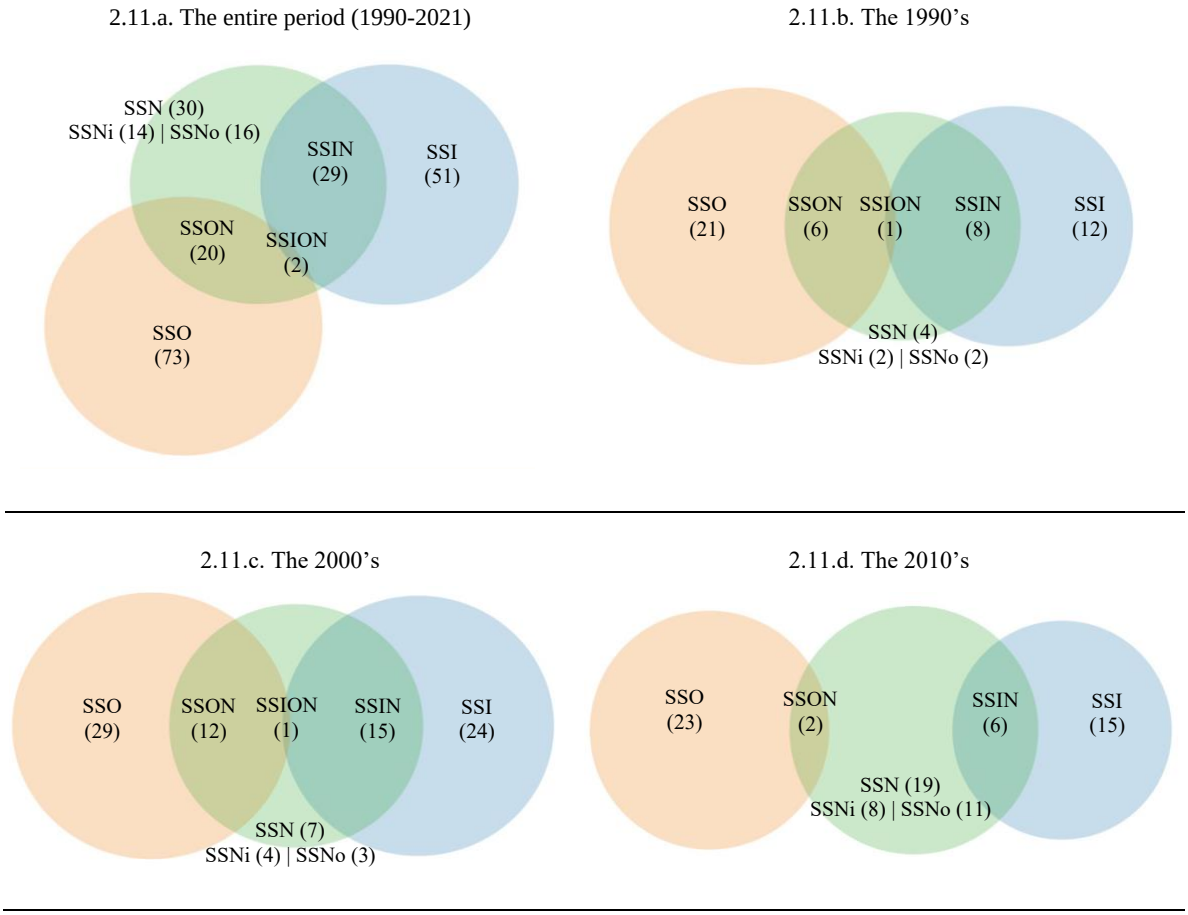


Figure 2.11. Number of sudden stops by type and decade (Developed economies)



There are also some characteristics of each decade that are very informative. For instance, during the 1990s, sudden stops in net flows largely coincided with sudden stops in gross inflows. In that decade, SSIN accounted for about 44% of all sudden stop subtypes in net flows. This proportion declines to 37% and 32% in the following two decades. This concurrence is in line with the early literature on sudden stops, which used to understand these events as mainly inflow-driven (Cavallo, 2019). Furthermore, the 1990's saw a marked difference between developed and developing economies. The latter faced more sudden stops, whose main drivers were inflows.

During the 2000's, there is a substantial increase in SSION episodes. They are sudden stops in net flows concurrent with extreme drops in both gross inflows and gross outflows. It should be noted that this decade encompasses the GFC, what actually can explain the sharply contraction in capital flows. Furthermore, the 2000's attested a kind of a rapprochement between the two sets of countries. On the one hand, during 2007-2009, developed economies experienced a significant increase in SSIN episodes, as could be seen in the figure 2.8. On

the other hand, in the 2000s, developing economies recorded a larger leap in the number sudden stops in gross flows, i.e. SSI and SSO. Thus, both "trend reversals" in developed and developing economies somehow bring them closer in terms of the profile of sudden stops they faced. One more observation of the 2000's is the increasing prevalence of outflow-driven net sudden stops (SSON). This is perhaps one of the most distinctive features compared to the previous decade, characterized by the prevalence of inflow-driven net sudden stops (SSIN). That could explain the increasing attention that gross flows gained in the literature during the first decade of this century. By the 2000`s, empirical evidence suggested the need to differentiate the main drivers of sudden stops in net flows.

Certainly, conclusions for 1990's and 2000's are in line with previous literature. However, the 2010's has been less studied. In aggregated terms, the most apparent feature of this decade is, perhaps, that incidence of these extreme movements has not increased significantly. If all types of sudden stops were simply added together, the result would be 219 episodes in the 2000's versus 220 in the 2010's. However, if looking beyond the aggregate number, there are also some noteworthy qualitative observations in the 2010's. For example, there seems to be a return to the trends of the 1990s. It is to say, sudden stops in net flows gain prominence in developing economies, but lose it in developed economies. Compared with the previous decade, all sudden stops subtypes in net flows increased 25% in the developing economies, but decreases 23% in the developed economies. What is more, in the 2010's, developed economies recorded only two SSON, six SSIN and zero SSION episodes, which is even less of what they recorded in the 1990's, when they recorded six, eight and one, respectively.

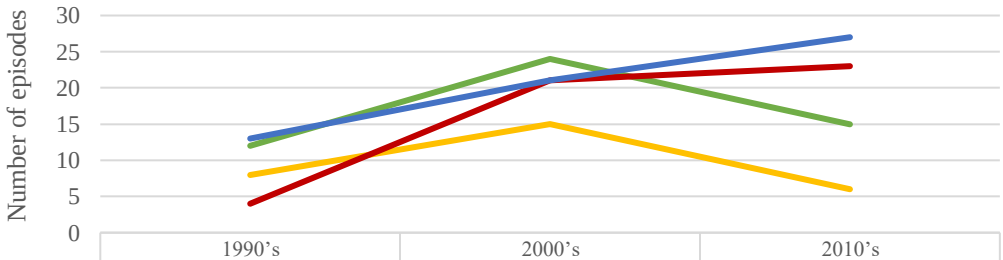
There is also a particular feature of the 2010's that cannot be overlooked. This is the substantial increase in SSN episodes worldwide. Looking at all countries, at each decade, while SSN represented around 8%, in the 1990's, and 9%, in the 2000's, of the total number of episodes; in the 2010's, that percentage rose to 20%. Now, considering all countries, during the entire period, 61% of all SSN took place in the 2010's, as can be inferred from the figure 2.9. That percentage is valid for developed and developing countries separately. In other words, during the last decade, developed and developing countries have been experiencing sudden stops in net flows driven by mild movements in inflows and outflows. However, it should be noted that developing economies keep facing simultaneously an increasing frequency of SSIN and SSON episodes. So the higher prevalence of SSN in the 2010's means a reconfiguration in the profile of sudden stops for developed economies, but, for developing economies, it means one additional subtype that also gained more relevance.

To recapitulate, the behaviour of sudden stops can be understood in three different moments, corresponding to the three different decades that has been studied in this thesis. The first two decades are in line with the main findings of the literature discussed in the first chapter. Generally speaking, the decade of the 1990s is characterized by inflow-driven sudden stops, which usually take place in developing economies. The 2000's bring the two sets of countries

closer together; net and gross sudden stops tend to occur in both developed and developing countries. Additionally, the 2000's spotlight the role of gross flows, especially because both sudden surge in gross outflows and sudden stops in gross inflows gain more power to explain sudden stops in net flows. However, the analysis of the 2010s allows us to contribute to the literature on a period that has not been explored so far. The main characteristics of the last decade has been the predominance of sudden stops in net flows driven by mild movements in outflows or inflows. This corroborates the importance of revising the original typology, by allowing the reclassification of the SSN episodes.

Regarding SSIN and SSI episodes, it is important to recall that both indicate that foreigners suddenly take their money out of the country. In summary, we could say that SSIN implies that the drop in inflows has been too large, so that it has created a sudden stop in net flows. In the case of SSI, the drop has also been large, but not large enough to create a sudden stop in net flows. Figure 2.12 simply displays the number of SSI and SSIN episodes by decade. It can thus be observed that these shocks are predominant in developing economies. In these countries, both types of sudden stops have continued to grow decade after decade. That can be partly understood if we consider that developing countries are mostly importers of capital. This condition places them in a vulnerable position to abrupt changes in the supply of capital. However, developed economies are not immune. In particular, SSI episodes show a significant prevalence among this latter set of countries.

Figure 2.12. Frequency of SSI and SSIN episodes by type of country and decade



	1990's	2000's	2010's
DVPED SSI	12	24	15
DVPED SSIN	8	15	6
DVPING SSI	4	21	23
DVPING SSIN	13	21	27

Next chapter aims to evaluate the impact of SSIN and SSI on economic growth over time. As shown in the first chapter, previous literature suggests that they are quite disruptive shocks. Moreover, the present trend analysis shows that they are an continuing concern, especially for developing economies, but not only.

CHAPTER III . THE DYNAMIC EFFECT OF INFLOWS-DRIVEN SUDDEN STOPS ON GDP

The risks of relying too heavily on international financing

The present chapter seeks to estimate the effect of SSIN and SSI episodes on the GDP. To that end, the thesis implements a dynamic econometric model, whose details will be explained in the first section of this chapter. A further section will be included below to present and discuss the empirical results for both types of episodes.

3.1 Methodology

To analyse the effect of sudden stops on GDP, the thesis relies on the impulse response function by Local Projections (IRF-LP) methodology, proposed by Òscar Jordà (2005). The idea consists in estimating the changes in our response variable, i.e. GDP growth, over a defined horizon, given the changes of our main independent variables, i.e. SSIN and SSI.

Therefore, our purpose is to evaluate the average dynamic effect of a shock on the economic growth path (GDP). Specifically, the dependent variable is the growth of "Gross Domestic Product, Seasonally Adjusted, Index" at quarterly basis, from the IMF-IFS dataset. In order to ensure comparability across countries and time, the country-specific GDP series has been indexed to 100 at t_0, being t_0 the quarter in which the sudden stop episode begins.

Consequently, this methodology seeks to answer the following question: How would the growth path of GDP change if a sudden stop episode occurs? Thus, the objective is to estimate the impulse response (IR) and the average cumulative response (ACR) of the GDP in the event of one of the episodes. Having said that, there are two equations to be estimated. The first equation estimates the impulse response of GDP growth to the shock:

$$GDP_{t+h} - GDP_{t+h-1} = \alpha_h + \gamma\{L\}GDP_{t-p} + \beta_h Shock_t + \delta_h Controls_{t-p} + \varepsilon_{t+h} \quad (3.1)$$

The second equation estimates the cumulative response of the GDP growth to the shock:

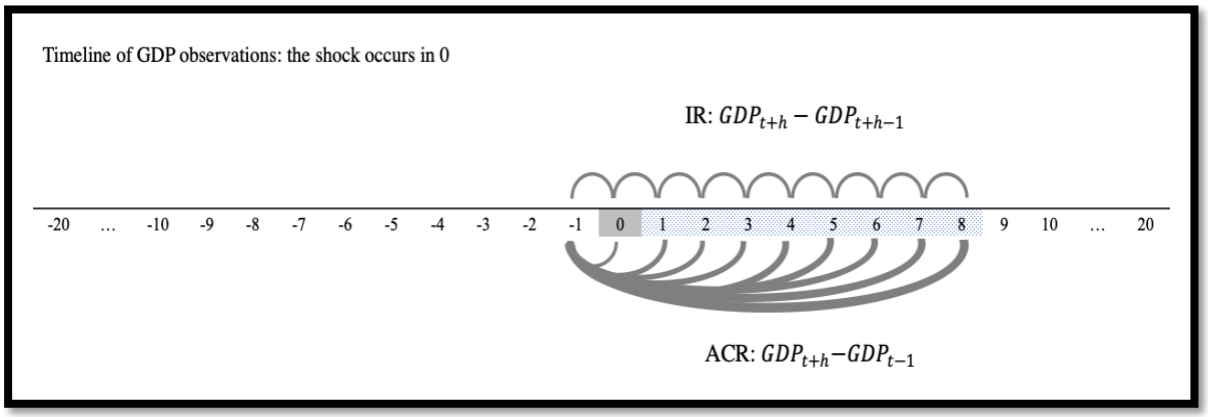
$$GDP_{t+h} - GDP_{t-1} = \alpha_h + \gamma\{L\}GDP_{t-p} + \beta_h Shock_t + \delta_h Controls_{t-p} + \varepsilon_{t+h} \quad (3.2)$$

where $GDP_{t+h} - GDP_{t+h-1}$ is the change of the GDP from one period to the next one. This is the dependent variable to estimate the impulse response of GDP to the shock. Now, to estimate the cumulative response, the dependent variable is $GDP_{t+h} - GDP_{t-1}$. It is the difference between GDP in each post-shock period and GDP in the pre-shock period.

We are interested in estimating the changes in the GDP starting from the shock, up to a horizon of h=0, …, H periods. The model will evaluate the effect up to two years later, so

H=8. This horizon has been defined *a posteriori* because the effect of the shocks lasts approximately for eight periods after t_0. Therefore, the collection of H regressions is denoted as local projections. The figure 3.1 aims to illustrate what are actually our dependent variables. If we consider the GDP timeline from t_{-20} to t_{20}, our results will display the effect over an eight-period horizon after the beginning of a sudden stop.

Figure 3.1. Definition of dependent variables: timeline of GDP observations



In addition, $\gamma\{L\}$ are matrices of coefficients for each lag *p* and horizon *h*. It is worth mentioning that we set *p*=0,1,2,3, in order to consider the historical GDP of a full year. Theses matrices measure the effect of previous GDP on the GDP itself. Now, the variable *Shock* is an indicator that takes the value of 1 in the quarter in which the sudden stop (SSIN or SSI) starts, multiplied by the magnitude of the drop in capital flows. The idea behind this multiplication is to control by the size of the sudden stop; otherwise, it would assume that all sudden stops are equivalent, which is not true. The magnitude of the sudden stop is measured as the sum of all flow drops recorded during the quarters it lasted, as a share of the annual GDP. It is necessary to clarify that, in case of SSIN, the magnitude is measured by considering the falls in net flows; in case of SSI, its respective flows are considered.

Based on the literature review, some lagged *Control* variables have been defined. Firstly, the current account deficit (CAD) as a share of GDP. Indeed, the effect of a sudden stop will depend on the size of the CAD, as the adjustment mechanism (RER) is triggered precisely to reduce it. Secondly, the degree of trade openness of an economy, i.e. the sum of exports and imports as a share of GDP. Trade openness could help to make the adjustment on the export side rather than on the import side, which has been found to be more costly. As a structural variable, whose changes are not radical in the very short term, annual data from the World Bank are considered. In addition, we include an interaction between these two variables and the shock. Thirdly, the effect of the interest rate in GDP growth was included using IMF-IFS data, namely the Central Bank Policy Rate. Fourthly, the model is also controlled by trend and quadratic trend. The variable Trend is the consecutive number of observations per

country, per period, taking values from 1 to 41 (see below). Each number was squared in case of quadratic trend. Finally, one more indicator, named Developing, was incorporated to differentiate developing and transition economies from developed economies.

To establish the transmission mechanisms, other dependent variables, indexed to 100 at t_0, were analysed. These are RER, imports, exports, private consumption, private investment and the level of leverage in external financing. All data are taken also from the IMF-IFS datasets. The same empirical strategy used for GDP were followed for each depended variable. However, in the case of imports and exports, the trade openness variable was excluded to avoid endogeneity.

In practical terms, we created a sub database for each type of sudden stop (SSI and SSIN). To avoid that different dimensions of the GDP_t vector affect the results, we keep the same number of observations for each shock. Then, for each episode, we consider 40 periods: 20 periods before and 20 periods after its beginning. It is to say 41 periods in total. Besides, if a country presents more than one episode of the same type, they are considered as though it was another country in the panel; for example, Mexico and Mexico_2. That clarification is necessary, because we need to index each GDP equal to 100 at each t_0. In addition, if the episode has occurred recently, i.e. there are not 20 subsequent quarters, then we consider the 41 most recent periods of the whole country-specific series.

3.2 Empirical results

First of all, it is important to keep in mind some definitions that could help to interpret the empirical results. In this respect, it is necessary to recall that, to identify sudden stops, we look at the Financial Account of the BOP. Specifically, we observe the annual change of inflows and outflows in each quarter. A sudden stop occurs when the time series of their annual changes falls below one historical standard deviation, subject to falling further to two historical standard deviations. It ends when the time series returns to levels above one historical standard deviation (figures 2.2, 2.3, 2.4). Again, the adjective "historical" means the standard deviation of the last 20 quarters, i.e. the last five years. It is therefore worthy to recognize that sudden stops *could* imply continuous drops in financial flows, reaching their worst level one or two quarters after their onset.

It is also important to remember that, in the BOP, inflows are the sum of liabilities incurred by residents abroad. Therefore, a drop in inflows in one quarter means that residents reduced the amount of money received from foreigners. In other words, foreigners stopped bringing money into the reporting economy. Consequently, if the annual change in inflows falls under two historical standard deviations, it means that gross inflows entered into a sudden stop mode. Outflows, however, are the sum of foreign assets acquired by residents. Hence, a drop in outflows in one quarters means that locals sent the money abroad, because they had to pay

to acquire more foreign assets. It is to say, domestic capital flows out of the country. Consequently, if the annual change in outflows falls under two historical standard deviations, it means that gross outflows entered into a sudden stop mode.

Finally, in the BOP, net flows are also named Net Financial Account. This is the sum of total liabilities (inflows) plus total assets (outflows). Thus, a drop in net flows in one quarter could means that foreigners stopped bringing money into the country or that locals sent their money abroad, or both. Consequently, if the annual change in net flows falls under two historical standard deviation, it means that net flows entered into a sudden stop mode. It is worth noting that it could be the case that inflows and outflows moved in opposite direction, so net flows remains stable, even if one the gross flows does enter into sudden stop mode. For instance, it could be the case that foreigners take their money out of the country, but locals bring their money back to the country. A further case could be that the sudden stop in one of the gross flows is too large that it outweighs any movement of the other gross flow, causing by itself a sudden stop in the net flows. Precisely, all these possible combinations could explain occurrence of SSI or SSIN.

As seen in the first chapter, literature has traditionally studied sudden stops in net flows. In general terms, the common conclusion has been that sudden stops in net flows provoke a crisis in balance of payments (BOP). In particular, an economy that faces a sudden stops in net financial account cannot finance its current account deficit (CAD). In order to reduce the CAD, according to the literature, economies devaluate the real exchange rate (RER). This is known as the adjustment mechanism. Through this depreciation, it is possible to promote exports or contract imports, so that the current account deficit becomes at least zero. The problem, as seen in chapter one, is that a sudden devaluation of RER could also provoke a drop in consumption and investment, causing ultimately a fall in GDP.

The question here is: once we have identified a greater heterogeneity of sudden stops, particularly SSIN and SSI, does this explanation hold for both types of sudden stops? Moreover, if SSI have a negative on GDP, what explanation can be given, if in theory this type of shocks does not require an adjustment in the CAD? To answer these questions, next session present empirical result for SSIN and SSI shocks. The idea is not only to estimate their effects on GDP, but to identify the transmission mechanism.

3.2.1 Sudden stops in gross inflows that imply a sudden stop in net flows (SSIN)

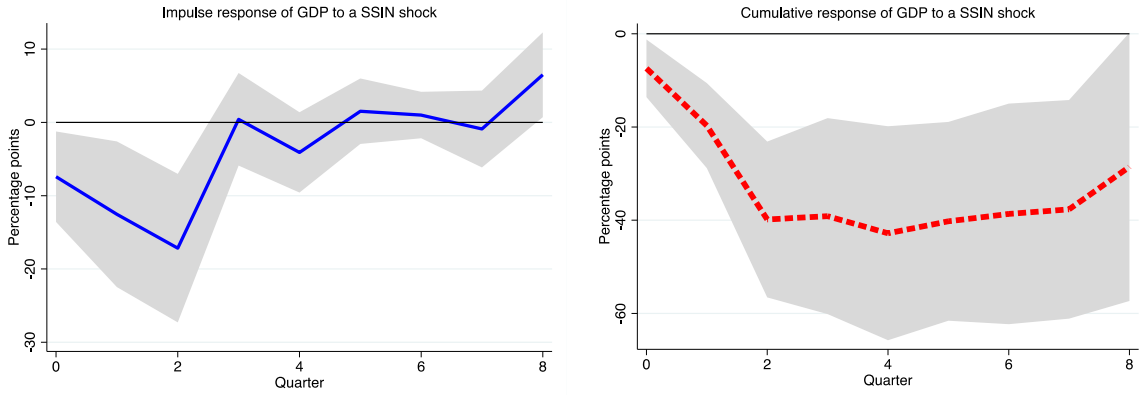
SSIN are sudden stops in net flows driven by sudden stops in inflows. This type of episodes can be understood as a large drop in gross inflows that is capable of causing a sudden stop in net flows by itself. In other words, foreigners suddenly took their money out of the country and there was no possibility to compensate for the loss of foreign capital, so the net flows entered into a sudden stop mode too. In short, international financing dries up.

Indeed, SSIN exhibit the largest effect on GDP. Figure 3.2 reports the results for these shocks. According to the model, a SSIN, whose fall in net flows is equivalent to 100% of GDP, causes an economic contraction of 7.4 percentage points right at the start of the shock. That is, if GDP were 100, immediately after the shock it would be 92.6. However, SSIN involving a magnitude equivalent to 100% of GDP are extremely rare. There is a more realistic way to understand this result. For example, given a SSIN, for every fall in net flows equivalent to 1% of GDP, there will be an economic contraction of 0.074 percentage points. Therefore, considering an hypothetical SSIN, whose fall in net flows equals 6% of GDP, it will lead to an economic contraction of about (0.06 x 7.4) = 0.44 percentage points, right at the start of the shock. In other words, GDP would fall from 100 to 99.56.

Our dynamic method, however, allows us to identify that effects of SSIN go beyond one trimester. As shown in figure 3.2, in the left panel, the effect continues to worsen over the next two quarters. In the second period, a SSIN, whose fall in net flows equals 1% of GDP, will cause an economic contraction of 0.17 percentage points. It could be more illustrative if we follow our example of a SSIN with a magnitude of 6% of GDP. Then, considering a GDP of 100, the effect perceived two quarters after the shock's onset will be (0.06 x 17) = 1.03 percentage points. Hence, in the second post-shock period, GDP will fall to 98.97. As mentioned above, this dynamic effect could be explained by the fact that normally the deepest falls in capital flows do not occur when the sudden stops starts. Therefore, the strongest effect on GDP is perceived a few quarters after the beginning of the shock.

Now, figure 3.2, in the right panel, reports the cumulative effect of SSIN episodes. It should be noted that the duration of its effects extends to a horizon of seven periods. The economy will need almost two years to overcome the effects of a SSIN shock. According to the model, SSIN progressively shrink GDP from period zero to period two. By that time, the cumulative effect is already about -0.4 percentage points, in case of a SSIN whose magnitude equals 1%. This effect will be roughly maintained from the second to the seventh period. Once again, we could consider an SSIN with a magnitude of 6% of GDP to illustrate this result. In that case, if GDP was 100 when the shock started, its cumulative contraction, two periods after the shock, will be (0.06 x 40) $\approx$ 2.4 percentage points. Hence, from period zero to period two, the GDP will continuously fall from 100 to 97.6 and, then, it will keep that level from the second to the seventh period.

Figure 3.2. Impulse response and cumulative response of GDP to SSIN

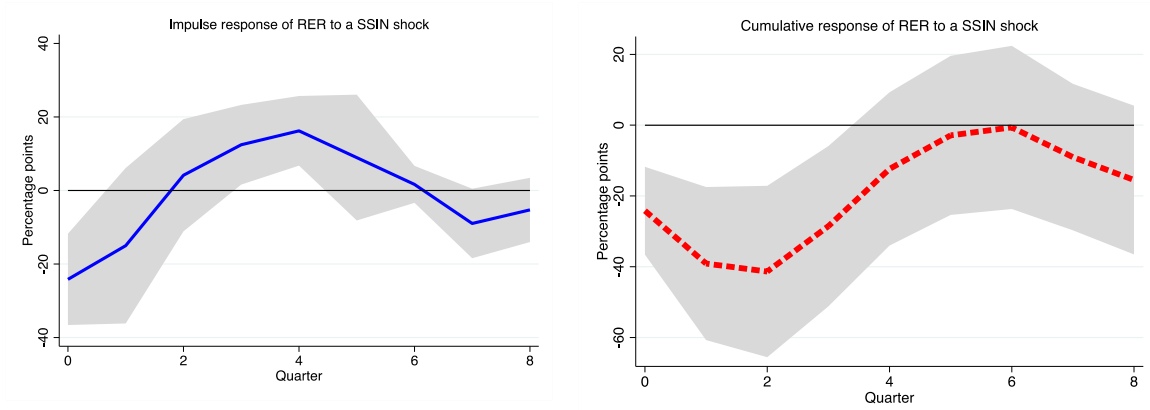


Note: 90% confidence bands are displayed in the grey areas; the blue and red lines show the IRF and ACR point estimate, respectively.

The transmission mechanism through which SSIN affects GDP starts with a depreciation of RER to adjust the BOP, as suggested by the literature (Calvo, Izquierdo, Mejía, 2004 and 2006, among others).This depreciation will subsequently translate into a fall in imports, in consumption, in investment and, ultimately, in GDP. The left panel of figure 3.3 shows that a SSIN with a magnitude of 1% of GDP causes a RER depreciation of 0.24 percentage points at the beginning of the shock. It is to say, the RER would immediately fall from 100 to 99.76. Now, the cumulative response, shown in the right panel, indicates that this effect would last for three periods. In the second period, the cumulative depreciation would reach its lowest level of around -0.41 percentage points. However, by the third period, the overall effect would slightly recover to -0.29 percentage points.

It should be noted that RER depreciation can occur as a result of market forces or monetary authorities' intervention. In that sense, country's exchange rate regime has an important explanatory power. Nevertheless, our results estimate the average effect of the SSIN on the RER, but do not reflect a differentiation by exchange rate regime. What literature has concluded, however, is that, after a SSIN, countries with a flexible exchange rate regime can attenuate its economic effects and recover more quickly (Edwards, 2004; Catão, 2004; Guidotti, Sturzenegger, Villar 2004, among others). For instance, a country that faces a sudden cut-off in financing, and must adjust without real exchange rate flexibility, it must do so through a reduction in spending. However, if the adjustment is achieved in part through RER depreciation, the country could better accommodate the new financing constraint by adjusting trade balance. That would help to mitigate the effect on economic growth. This is true even if a relatively large devaluation is required to generate the necessary improvement in the trade balance (Frankel and Cavallo, 2004). In short, it is possible to say that, under a flexible exchange rate regime, we could expect larger RER depreciations, but lower and quicker effects on GDP.

Figure 3.2. Impulse response and cumulative response of RER to SSIN



Note: 90% confidence bands are displayed in the grey areas; the blue and red lines show the IRF and ACR point estimate, respectively.

After a RER devaluation, the transmission mechanism continues to reduce imports. The logic behind the RER depreciation is to increase exports or a decrease imports to adjust the current account deficit (CAD). Our results show that, in general terms, SSIN leads to a reduction in imports, but not necessarily to an increase in exports. Figure 3.3 report the effect on imports and exports, respectively. On the one hand, the left panel of figure 3.3.1 exhibits a drop in imports of around 0.13 percentage points at the beginning of the SSIN. These results refer to a SSIN with a magnitude of 1% of GDP. In cumulative terms, the right panel of figure 3.3.1shows that the effect on imports is long lasting. The reduction in imports will persist from the zero to the seventh period. If we return to our example of a SSIN, whose magnitude is 6%, the effect on imports would be a reduction of (0.06 x 13) ≈ 0.8 percentage points in period zero. Therefore, imports would immediately drop from 100 to 99.2 and would remain at approximately that level for the next two years.

On the other hand, our model found no effect on exports in the face of a RER devaluation caused by an SSIN. At least not in the average of our countries sample. Figure 3.3.2 shows a non-significant effect on exports. In cumulative terms, however, there are a significant effect during the first and second post-shock periods. The effect is a reduction of about 0.06 percentage points, in the case of an SSIN with a magnitude of 1% of GDP. Certainly, a depreciation of RER could not explain a reduction in exports. However, one possible explanation could be related to the loss of the overall consumption or investment capacity of the economy (see below). That is why the effect on exports is not perceived immediately in a specific period, but over time. On the contrary, the RER depreciation could explain that, on average, exports suffer practically no effects in the aftermath of a SSIN. Indeed, the negative effect found is small and very short-lasting.

Figure 3.3. Impulse response and cumulative response of Imports and Exports to SSIN

Figure 3.3.1 Impulse response and cumulative response of Imports to SSIN

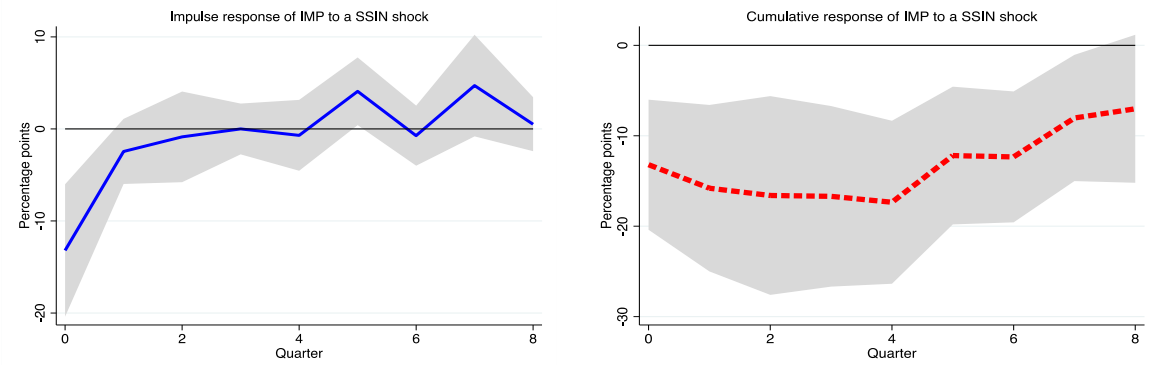
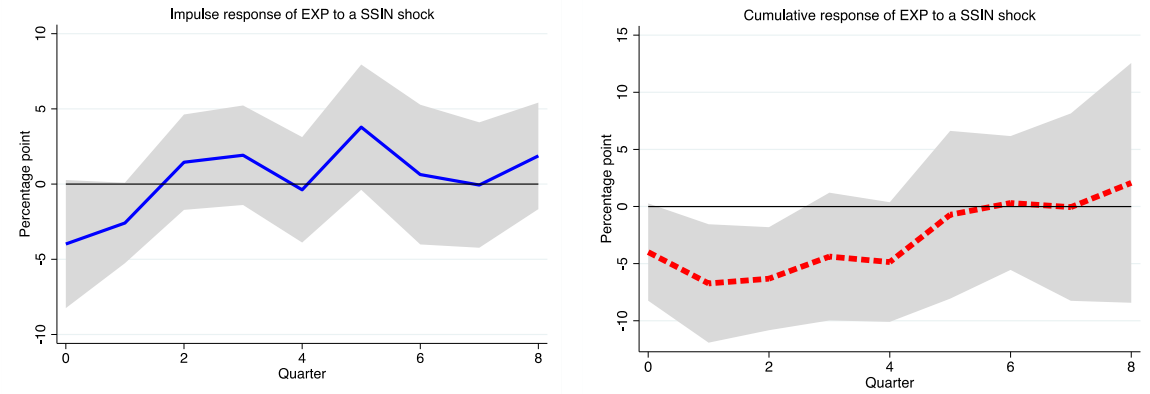


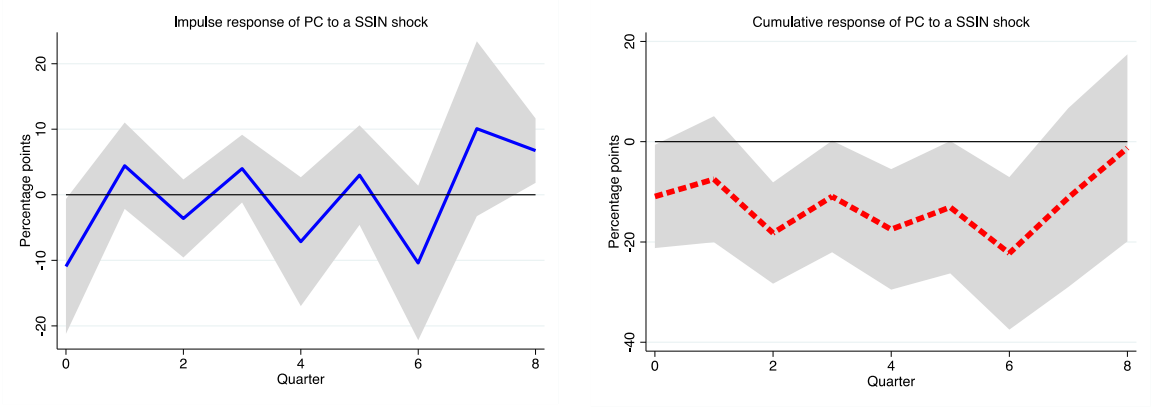
Figure 3.3.2 Impulse response and cumulative response of Exports to SSIN



Note: 90% confidence bands are displayed in the grey areas; the blue and red lines show the IRF and ACR point estimate, respectively.

Therefore, there are, *grosso modo*, two ways to adjust the trade balance in the face of a net sudden stop. If there is no possibility of triggering a devaluation of the RER, the alternative is simply to reduce spending. Usually, there is a combination of both. Indeed, a fall in imports, caused by a RER depreciation, can also be seen as a way to reduce spending, especially if exports remain unaffected. In other words, people lose purchasing power over imported products. Our results seem to suggest that scenario. Figure 3.4 shows the behaviour of private consumption in the aftermath of a SSIN. The left panel indicates that the effect on private consumption is felt immediately, causing a reduction of 0.11 percentage points, if the SSIN magnitude is 1%. Furthermore, the right panel shows that this effect is maintained over time. It is progressively perceived, summing by the sixth period a drop of 0.22 percentage points. It is to say, by the sixth period, the level of private consumption would fall from 100 to 99.78, if the SSIN magnitude is 1%.

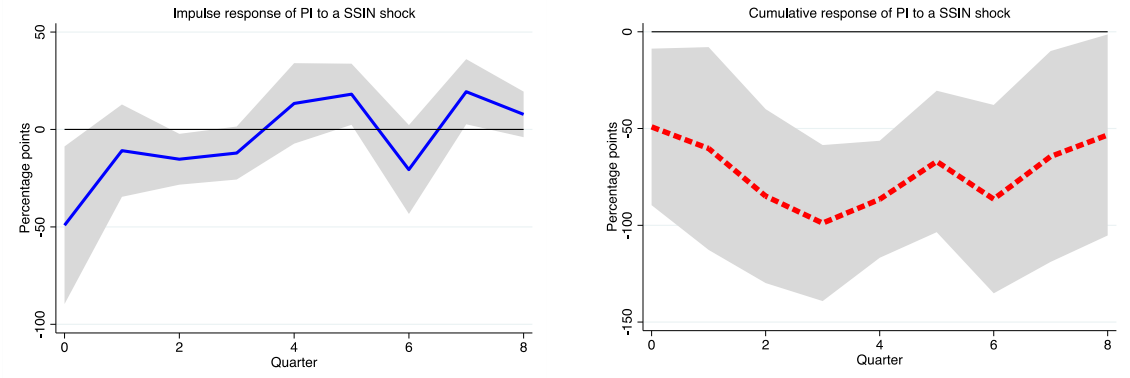
Figure 3.4. Impulse response and cumulative response of Private Consumption to SSIN



Note: 90% confidence bands are displayed in the grey areas; the blue and red lines show the IRF and ACR point estimate, respectively.

Following this line of transmission, a reduction in spending is not only perceived in the level of private consumption, but also in the levels of private investment. Figure 3.5 shows the behaviour of private investment after a SSIN. According to our results, an SSIN with a magnitude of 1% could cause a drop of 0.5 percentage points right at the beginning of the shock, as shown by the left panel of figure 3.5. It is to say, the level of private investment would immediately fall from 100 to 99.5. Moreover, the cumulative response, shown by the right panel, indicates that this effect worsens over time, reaching an overall drop of almost one percentage point by the third period, if the SSIN magnitude were 1%. What is more, the effect lasts for the entire period, from period zero to period eight. Certainly, changes in investment constitute, the main channel through which SSIN affect economic growth.

Figure 3.5. Impulse response and cumulative response of Private Investment to SSIN



Note: 90% confidence bands are displayed in the grey areas; the blue and red lines show the IRF and ACR point estimate, respectively.

Figure 3.5 suggests that, on average, private investment is highly dependent on international financing. Thus, these results bring the attention to the risks of relying too much on international savings to promote domestic investment. Cavallo, Eichengreen, and Panizza (2018), for example, studied the use of foreign savings to promote domestic investments. They concluded that periods of over-reliance on foreign financing could end abruptly, with current account compression and a sharp slowdown in investment and growth. From a basic national accounting point of view, there is an explanation that could shed some light on the effects of SSIN on investment. Considering, *grosso modo*, that:

$GDP = consumption(C) + government\ spending(G) + investment(I) + exports – imports(X\text{-}M)$
and
$Current\ Account\ (CA) = (X - M)$
and
$Savings\ (S) = GDP - C - G$

therefore,
$GDP = C + G + I + CA$
$GDP - C - G - I = CA$
$CA = S - I$

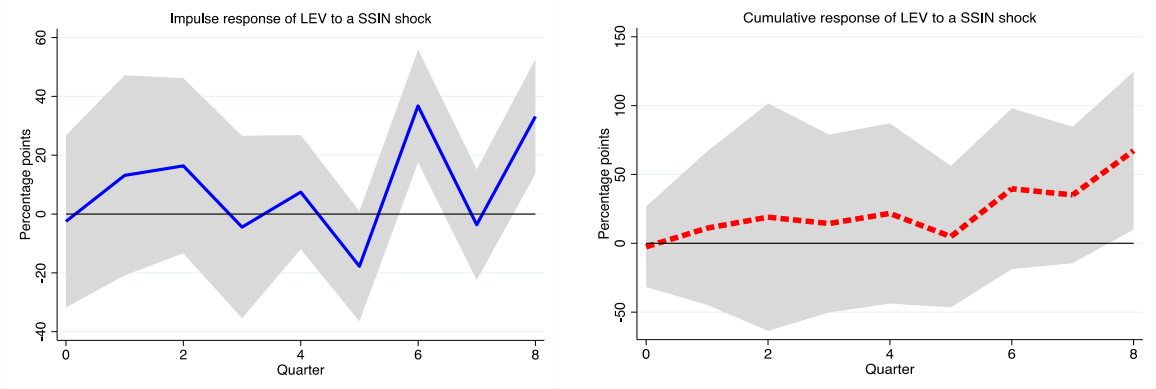
implying
$I = S - CA$
$I = S - X + M$

In conclusion, we can observe that investments are negatively related to the current account. That is, lower levels of current account (deficits) are related to higher levels of investment. This means that investment is being financed by the current account deficit, especially if savings levels are low. Therefore, a forced adjustment of the current account deficit, due to an SSIN, could, with a high probability, translate into a decline in the level of investment and, hence, of economic activity. Following our narrative, we can say that SSIN forces a reversal of current account deficit through depreciation of RER. Then, economic agents would no longer be able to finance investments. It may be because they have to pay for more expensive imports instead of investing or because they can no longer import part of the goods needed in the investment process. In any case, our results suggest that, after a SSIN episode, new financing constraints are met, first, by a decline in investment and, second, by a decline in consumption. This combination of consequences ultimately leads to a decline in GDP.

Finally, it is important to recognize the explanatory power of the exposed transmission mechanism. Our results on SSIN do confirm what previous literature has found. The RER depreciation unleashes a series of economic consequences that eventually lead to a decrease in GDP. In that sense, it is worthy to discard an alternative explanation that could be valid

for other types of sudden stops (i.e. the case of SSI). For example, it could be the case that the sudden stop directly causes an abrupt deleveraging of economic agents that depend on international loans. One way of assessing this is to consider foreign deposits in the domestic banking system as an indicator of domestic leverage on international funding. This data is recorded in "Others Investments Liabilities (OIA)" section of the International Investment Position (IIP) series, reported by the IMF-IFS (see below). However, as the figure 3.6 shows, there is no negative and significant relation between SSIN and the level of international leverage. The next section will elaborate on this alternative explanation, but so far our results confirm that there is no evidence to support this for the case of SSIN shocks.

Figure 3.6. Impulse response and cumulative response of International Leverage to SSIN



Note: 90% confidence bands are displayed in the grey areas; the blue and red lines show the IRF and ACR point estimate, respectively.

There are some noteworthy contributions in the case of SSIN. Certainly, the work of Cavallo, Powell, Pedemonte and Tavella (2013) is closer to this thesis in terms of recognizing greater disaggregation about the types of sudden stops. They also found the SSIN as the most disruptive shocks. However, they stopped the analysis at the effect on the GDP and RER, leaving the whole transmission mechanism implicit. In this thesis, we go deeper in exploring the transmission mechanisms and the dynamic effects of sudden stops. In certain way, present results constitute an extension of their work, not only because it completes the transmission mechanism, but because its dynamic methodology allows us to understand the absorption time of these shocks. Now, as noted above, the exposed transmission mechanism hold in the case of SSIN. Next section asses the effect of sudden stops in gross inflows (SSI). In this case, theoretically, a current account adjustment would not be necessary.

3.2.2 Sudden stops in gross inflows that do not imply a sudden stop in net flows (SSI)

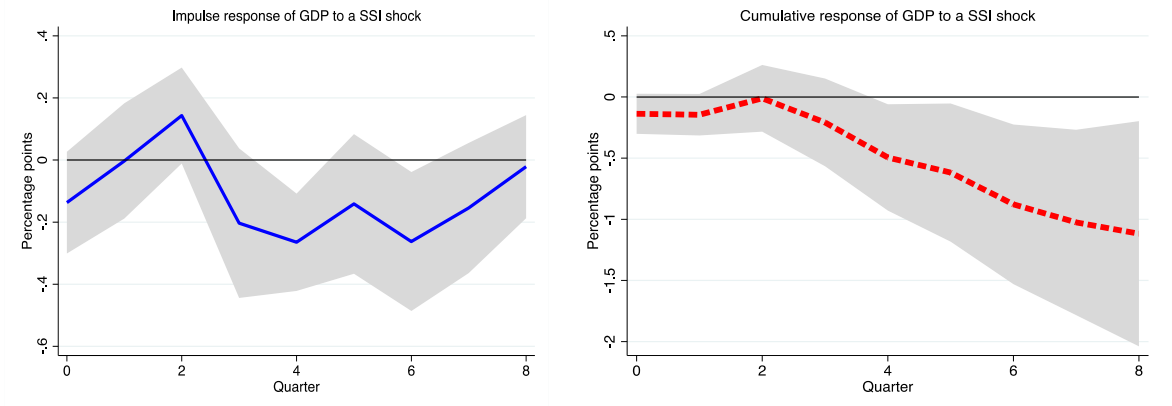
SSI can be defined as a large drop in gross financial inflows, but not large enough to create a sudden stop in net flows. In this scenario, foreigners suddenly stopped bringing their money into the country, but somehow it did not lead to net sudden stop. It could be the case, for

example, that foreigners took their money out, but residents brought theirs in. There could be many other reasons too. However, the key element here is that even if international financial inflows drastically shrink, the net financial account do not enter into a sudden stop mode.

The results of our model, reported in figure 3.7, suggest that these types of shocks also have a negative effect on GDP. However, there are two main differences with respect to SSIN. Firstly, the effect is not felt immediately or in the very short term. The strongest effect is perceived in the fourth period after the onset of the shock, as shown by figure 3.7, in the left panel. This could be partly explained if we consider that, on average, sudden stops in gross flows tend to be longer lasting (Table 2.5). Secondly, the effect of the shock is much lower. For example, given a SSI, for every fall in gross inflows equivalent to 1% of GDP, there will be an economic contraction of 0.003 percentage points in the fourth period. In other words, if GDP was 100 at the beginning of the shock, it would fall to 99.997 four periods later. Now, assuming an SSI with a magnitude equal to 6%, the drop would be (0.06 x 0.3) ≈ 0.02 percentage points in period four. That is, GDP would fall approximately from 100 to 99.98.

One more difference can be seen in cumulative terms. The effects of SSI shocks are perceptible beyond a two-year horizon, as can be seen in the right panel of figure 3.7. After an SSI, GDP begins to contract in the fourth quarter and continues this trend for more than one year. By the eighth quarter, the fall already adds up to -0.01 percentage points, if the magnitude of the shock were equal to 1% of GDP. However, if magnitude of SSI was 6%, the effect two years after its inception would be (0.06 x 1) = 0.06 percentage points less. It is to say, the GDP would fall from 100 to 99.94 over a two-year period.

Figure 3.7. Impulse response and cumulative response of GDP to SSI

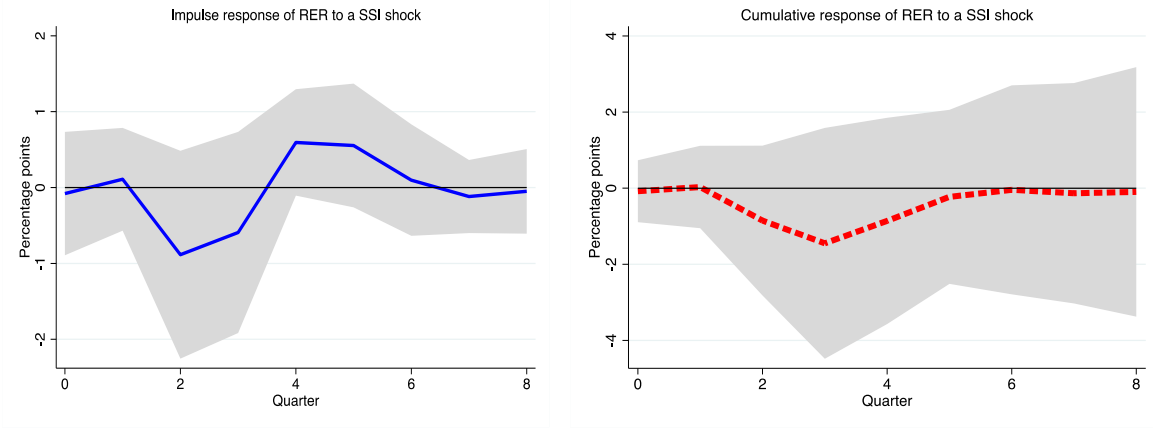


Note: 90% confidence bands are displayed in the grey areas; the blue and red lines show the IRF and ACR point estimate, respectively.

To explain how GDP is affected by a SSI, traditional literature is no longer valid, because it was written for net sudden stops. When a SSI occurs, by definition, the net financial account does not suffer a sudden stop. That is why there is no need to adjust the current account.

Consequently, the depreciation of the real exchange rate (RER), as an adjustment mechanism, loses all its explanatory power. In fact, figure 3.8 depicts the effect of the SSI on the RER. As can be seen, a SSI does not have a significant effect on the RER over the entire period.

Figure 3.7. Impulse response and cumulative response of RER to SSI



Note: 90% confidence bands are displayed in the grey areas; the blue and red lines show the IRF and ACR point estimate, respectively.

Thus, if the RER does not depreciate, we could expect no effect on exports and imports. This is true for exports. Figure 3.8.2 reveals that there are practically no consequences on the level of exports as a result of a SSI. However, this is not the case for imports. Figure 3.8.1 shows that, even if there is not a large drop in a particular quarter, imports accumulate significant decreases after the fourth quarter. The left panel of figure 3.8.1 indicates that, starting in that period, imports are reduced by about 0.01 percentage points, as a result of a SSI with magnitude of 1%. That is, imports would fall from 100 in period zero to 99.99 in period four and will maintain that level for at least the next four periods. If the magnitude of SSI were 6%, the imports contraction would be equal to (0.06 x 1) = 0.06 percentage points. It means a reduction from 100 to 99.94 during the last four periods. This reduction in imports certainly affects GDP. However, there is no evidence to suggest that imports are reduced due to a devaluation of the RER. There must be another alternative explanation.

Figure 3.8. Impulse response and cumulative response of Imports and Exports to SSI

Figure 3.8.1 Impulse response and cumulative response of Imports to SSI

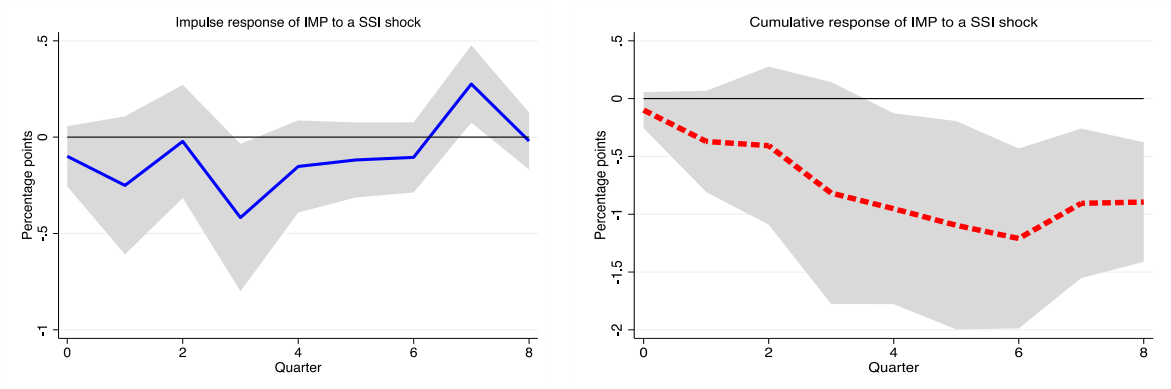
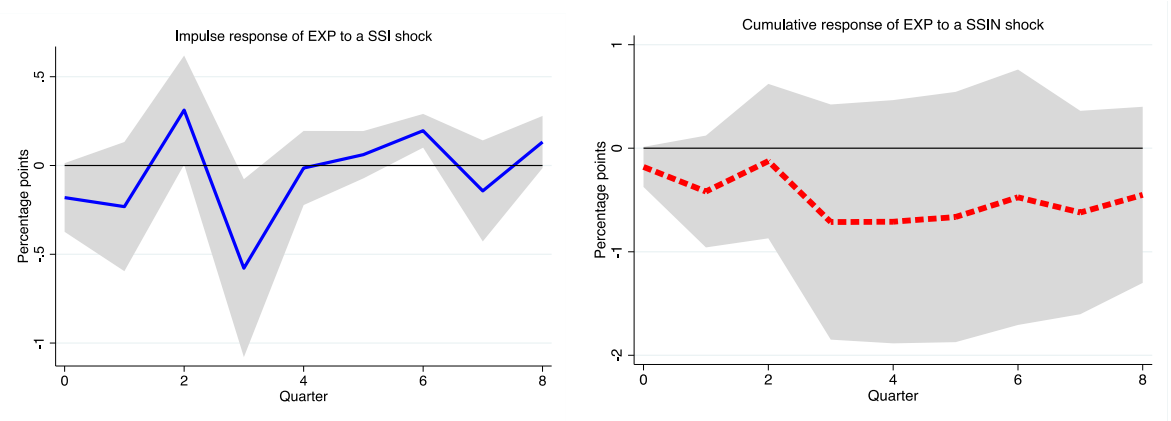


Figure 3.8.2 Impulse response and cumulative response of Exports to SSI



Note: 90% confidence bands are displayed in the grey areas; the blue and red lines show the IRF and ACR point estimate, respectively.

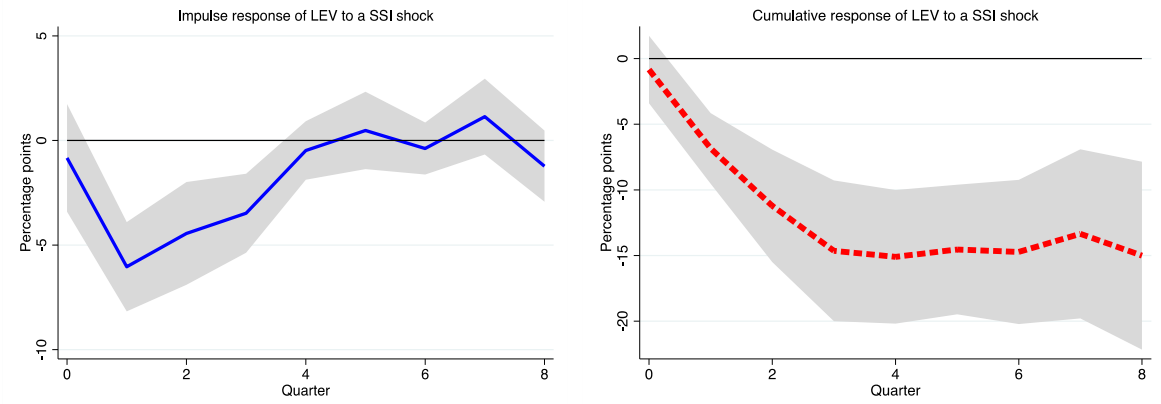
Not many authors have addressed the transmission mechanism of SSI effects on GDP. To do so, it is necessary to study sudden stops in gross capital flows, which have only recently become an academic concern. However, some clues can be found in Cavallo, Powell, Pedemonte and Tavella (2013), who argue that extreme movements in gross inflows could have destabilizing effects on the different economic actors. They specifically suggest that forced deleveraging could be disruptive. However, they accept that further analysis is needed to draw such a conclusion. The hypothesis of a forced deleveraging process implies that economic agents suddenly meet their international credit obligations without an alternative source of financing. That means they will have to accommodate the new financial constrains by reducing consumption and investment. Furthermore, it implies that the sudden stops occurs mainly because foreigners withdraw their investments from the domestic banking system. It also could lead to banking crisis.

Therefore, following this idea, our analysis takes into account foreign deposits in the domestic banking system as a proxy for the level of leverage on international funding sources. This data is recorded in "Others Investments Liabilities" section of the International Investment Position (IIP) series, reported by the IMF. In contrast to the BOP, which shows transactions, the IIP shows stocks, at a given point in time; both the stock of assets and liabilities of residents with respect to non-residents. In that way, IIP allows us to look beyond the change in flows, by understanding deleveraging as the change in the total stock of international liabilities. Then, a reduction in the foreign liabilities, reported in the OIL-IIP, means *grosso modo* a fall in the total level of foreign deposits. This, in turn, implies a process of deleveraging of residents from international financing.

Figure 3.9 reports the effect of SSI on the level of international leverage. Effectively, these type shocks produce a sudden deleveraging process in the economy. The level of foreign deposits in the domestic banking system begins to decline sharply from period one. The left panel of figure 3.9 shows that, in the first period, the reduction is equal to 0.06 percentage points, if the SSI magnitude were 1% of GDP. Considering a stock of foreign deposits equal to 100, it means that a SSI of magnitude 1% will reduce that stock to 99.94 only over one period of time. If the magnitude of the SSI were 6%, the fall would be equivalent to (0.06 x 6) = 0.36 percentage points. In other words, the stock of foreign deposits would go from 100 to 99.64 in just one quarter.

In cumulative terms, our results suggest that the effects of SSI are quite long-lasting. They can be felt beyond a two-year horizon. After an SSI, the level of international leverage is continuously reduced from the first to the third period. At that point, it reaches a drop of 0.15 percentage points and maintains approximately that level for the entire period. Our example of a SSI, whose magnitude is 6%, could illustrate this result. In that scenario, the accumulated drop by the third period would be (0.06 x 15) = 0.9. That is, the stock of foreign deposits would decrease from 100 in period zero to 99.1 in period three, and will keep approximately that level beyond period eight.

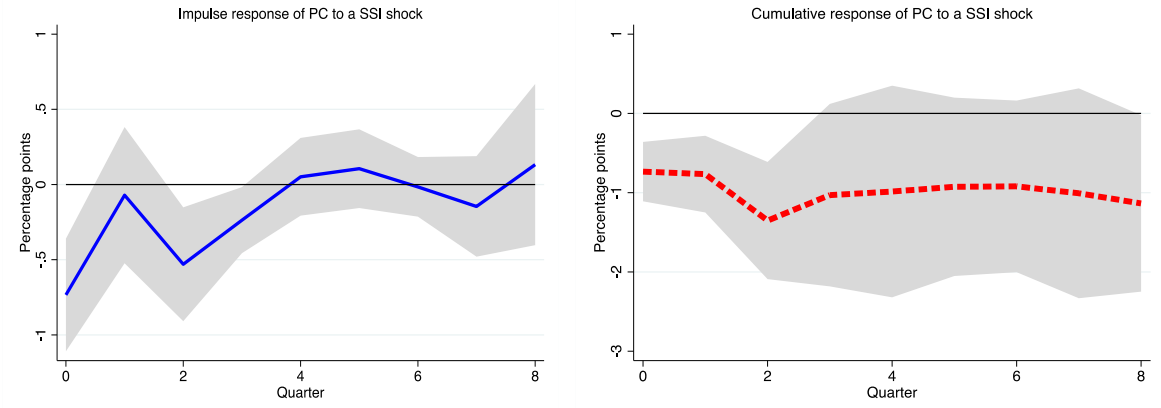
Figure 3.9. Impulse response and cumulative response of International Leverage to SSI



Note: 90% confidence bands are displayed in the grey areas; the blue and red lines show the IRF and ACR point estimate, respectively.

Following this transmission mechanism, the fall in the international leverage will lead to a contraction of consumption and investment. Figure 3.10 shows the results for private consumption. Effectively, SSI cause a slight contraction from period zero to period two. The most important drop occurs immediately after the shock, equivalent to 0.0075 percentage points, if the SSI magnitude is 1%. This effect, however, is quickly absorbed. By the third period, it will have worn off, as shown by the right panel. Intuitively, we could say that, under pressure to meet their international credit obligations, the first measure taken by economic agents is to reduce consumption. However, this measure seems to be temporary, at least until they can implement other measures such as reducing investment. Thus, it is difficult to attribute the fall in GDP primarily to the fall in consumption. While the effect on consumption is felt in the first three periods, the effect on GDP is felt in the last four.

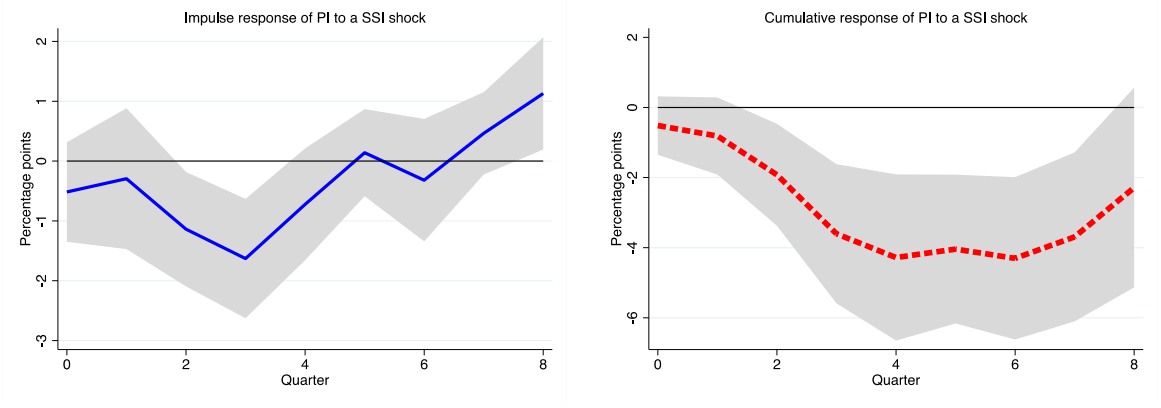
Figure 3.10. Impulse response and cumulative response of Private Consumption to SSIN



Note: 90% confidence bands are displayed in the grey areas; the blue and red lines show the IRF and ACR point estimate, respectively.

Figure 3.11 shows the effect of SSI on private investment. The largest drop in the level of private investment occurs three periods after the start of the shock. In that moment, the drop is equivalent to 0.02 percentage points, if the SSI magnitude is equivalent to 1%. However, in cumulative terms, the right panel indicates that, already by the second period, the sum of drops begins to have significant effects. From that period on, private investment falls by about 0.05 percentage points if the SSI magnitude is equivalent to 1%. This means that, considering an investment level of 100 in period zero, the SSI will drag it down to 99.95. It will approximately maintain that level until the seventh period. It is worth noting that, after a SSI, the behaviour of private investment practically mirrors that of international leverage levels. This allows us to conclude that a forced deleveraging, triggered by an SSI episode, fundamentally implies a de-financing of private investment, which constitute the main channel through which the GDP is affected.

Figure 3.11. Impulse response and cumulative response of Private Investment to SSIN



Note: 90% confidence bands are displayed in the grey areas; the blue and red lines show the IRF and ACR point estimate, respectively.

In conclusion, the analysis of SSI episodes has allowed us to draw a transmission mechanism little studied so far. Effectively, explanations given for net sudden stops do not hold in case of SSI. The evidence suggest that the RER does not suffer any effect as result if these shocks. An alternative explanation must be provided. The first indication we identify is that the SSI implies (unlike the SSIN) a large cutback of foreign deposits in the domestic banking system. Therefore, in general terms, this thesis suggests that SSI causes a sudden decrease in the level of international leverage of residents. This destabilizes economic agents, due to the need to promptly meet their foreign credit obligations, but also to the reduction of international financing in general (i.e. loans). The consequent financial constraints must therefore be addressed by reducing consumption, imports and, above all, investment. All of this ultimately leads to a decline in GDP.

CONCLUSION

The study of sudden stops has evolved since its inception in the mid 1990s. In a first stage, the literature mainly sought to understand their definitions, causes and possible measures to deal with them. Later, analyses of their possible consequences have been gradually incorporated. The present thesis has aimed to contribute to this recent strand of literature. To this end, our research has been based on two fundamental questions. One of them concerns the main trends in sudden stops around the world. The idea was to disaggregate the concept of sudden stop in seven different types and analyse their major tendencies. The other question is what is the effect of two specific types of sudden stops, which have proven to be the most costly shocks in terms of GDP contraction. They are SSI and SSIN. The aim here was not only to estimate the effect, but to estimate the effect over time, as well as to explain the transmission channel through which GDP is affected.

Regarding the first research question, results show that the development of the literature maintains a parallel relationship with the main trends in sudden stops. For example, our findings confirm that, during the 1990's, the majority of shocks that occurred were subtypes of sudden stops in net flows. Besides, about 7 out of 10 sudden stops in net flows were related to large drops in gross inflows. They were manly SSIN. That can explain why, during this decade, literature generally defined sudden stops as large drops in net flows motivated by large drops in inflows. Furthermore, these types of shocks are more frequent in developing economies. Not surprisingly, during these years, the general concept of sudden stops were associated with these countries.

In the following decade, in the 2000's, our results reveals that sudden stops in gross inflows and outflows increased as never before, in both developed and developing countries. As illustration, from one decade to the next, the total number of SSO more than doubled, while the number SSI more than tripled. Besides, this decade saw an important increase of outflow-driven net sudden stops. The truth is that these changes do not occur uniformly throughout the 2000s. For the most part, they become apparent in the wake of the GFC starting in 2007. An additional consequence of the GFC is an increase in the prevalence of net sudden stops in developed economies, particularly SSIN. That is perhaps the most distinctive feature with respect to the previous decade. Thus, as a result of all these movements in the international financial scenario, the literature responded by incorporating the analysis of gross financial flows into the literature on sudden stops. From this decade on, sudden stops began to be understood as challenges derived from international financial integration in general terms.

Being the most recent decade, the main trends of sudden stops in the 2010s has been relatively little studied. Our results show a significant increase in the number of sudden stops in net flows that do not imply sudden stops in any of the gross flows (SSN). The increase in SSN, however, has different meanings for developed and developing economies. In the case of

developed economies, the increase in SSN occurs at the same time as a more than proportional decrease in all other subtypes of net sudden stops. The result, therefore, is an overall decrease of net sudden stops. In the case of developing economies, the increase in SSN occurs simultaneously with an increase in all other subtypes of net sudden stops. In particular, the number of SSIN episodes rose significantly. Thus, the general result is a large increase in the total number of net episodes. Consequently, it is possible to say that, in the 2010's, we experienced a return to the profile of the 1990s. That is, the number of sudden stops in net flows climbed in developing countries, but declined in developed countries.

The analysis of sudden stop based on the movements of gross and net flows has nurtured the study of the consequences of these types of shocks. This disaggregation, which emerged in the first half of the 2010s, has prompted a fundamental question in the development of this thesis, but also in the evolution of the literature in general. The question is which kind of sudden stop is more disruptive to economic growth? The general conclusion reached so far is that sudden stops driven by inflows are the most costly shocks to the economy. The present thesis departed from this conclusion to study the effects of sudden stops on GDP. Then, following this focus on gross inflows, a large decline of them could create two types of sudden stops: SS**I**N and SS**I**. The first type refers to a sudden stops in gross inflows that creates a sudden stop in net flows. The second type refers to a sudden stop in gross inflows only. In both cases, economies face a cutoff in access to international financing.

Therefore, regarding the second research question, the thesis proposes to use a dynamic approach to understand the effects of SSIN and SSI on GDP. That constitutes an extension of previous finding in the literatures. For example, Cavallo et al. (2013) contributed to clearly define SSIN and SSI shock, as we understood them in this thesis. However, they study the effect on GDP by using a static methodology. They compare the average level of GDP ten quarters after and ten quarters before the onset of the shock. Now, Hwang et al. (2017), first of all, use a different definition of inflow-driven sudden stops. Their definition not only exclude SSI, but do not consider the dimension of the gross inflows. They do use a dynamic method, which reveals that the effect of sudden stops can be perceived even after their onset. However, it is not possible to conclude when the effect of the shock will be worn off. In both works, the main concern is to identify which kind of sudden stops is costlier. Therefore, in neither case do they go further to explain the transmission channel through which GDP is affected. That is also a pending task that this thesis undertakes.

This thesis uses the method of Local Projections. This approach makes it possible to identify in which periods and to what extent a sudden stop affects the evolution of GDP. Additionally, this methodology allows us to calculate the average cumulative effect over a determined horizon. In other words, it allows to observe the time that an economic requires to absorb the effects of the shock. A further contribution of our empirical strategy is the operational definition of sudden stops. The literature review suggests that all previous studies on the

economic effects define the shock variable as an indicator. Thus, it takes the value of 1 in the period in which it occurs and 0 otherwise. Implicitly, that assumes that all drops in financial flows, due to a sudden stops, are equal, which is not true. In this thesis, we consider the magnitude of the shock. The magnitude is defined as the sum of all the financial falls that occurred while the sudden stop was in progress as a share of annual GDP. This change has substantial implication for the interpretation of the results. The thesis do not estimate the effect of SSIN and SSI in general, but according to the financial cuts they imply.

The empirical results for SSIN and SSI reveals important differences. One the one hand, SSIN are the most disruptive shocks. Their effects are perceived from period zero, but their worst effects are perceived two periods later. The reason has to do with the fact that sudden stops imply consecutive drops in financial inflows during several quarters. Therefore, probably, the largest drops could occur one or two quarters after their beginning. In terms of absorption time, an economy will require about two years to fully overcome the effects of SSIN. On the other hand, SSI are less disruptive, but they still present significant negative effects on GDP. Besides, their effect are longer lasting. Our results suggest that SSI effects will be perceived four quarters after their onset. From that moment on, the cumulative effect will get worst continuously. It requires more than two years to overcome an SSI.

The literature offers plenty of analytical tools to understand the transmission mechanism of SSIN. It is important to recall once more that SSIN imply that foreigners suddenly took their money out of the country and there was no possibility to compensate for the loss of foreign capital, so the net flows entered into a sudden stop mode too. The fact that net flows enters into a sudden stop mode means that the financial account that is used to pay the current account deficit (exports-imports) suddenly dries up. The question now is how the current account deficit will be paid. In this scenario, the economy usually adjust by reducing the real exchange rate (RER). Through such depreciation, it is possible to reduce imports or promote exports, thus reversing the current account deficit. Our results suggest that, on average, after a SSIN, the RER suffer an important devaluation. The imports do decrease, but exports remain mostly invariable. The subsequent financial constrains reduce the consumption and, most importantly, the investment capacity of economic actors. In fact, the investment is the main channel through which a SSIN affect GDP. This is so, because on average the investment is being mostly financed by the current account deficits. Then, the forced reversal of the current account will translate into a forced reversal of investment trends.

In the case of SSI, as a phenomenon inherent to gross financial flows, the literature has only recently addressed it. Unlike the previous inflows-driven shock, SSI do not imply a sudden stop in net flows. This means that the financial account never dries up. Consequently, the economy will not suffer a current account reversal. Then, in this scenario, a RER depreciation has no explanatory power. Effectively, our results showed that the effect of SSI on RER is not different from zero. Therefore, there must be an alternative explanation to understand the

resulting economic contraction. In that sense, our analysis conclude that SSI imply a deleveraging process of economic actors, which provoke a destabilizing effects. It is to say, foreigners suddenly withdraw their money from the domestic banking system. In fact, on average, after a SSI, the international position of countries as receivers specifically of foreign deposits decreases substantially. In order to meet the imposed financial constraints, economic actors reduce mainly level of investment. Thus, investment keep being the main transmission channel through which GDP is affected. That reduction in investment can also explain why the effect of SSI on GDP is much longer lasting, since usually the effects of [lack of] investments on economic growth are perceived in longer horizons.

Certainly, drawing some general conclusion from an analysis encompassing such quantity of countries during a period of three decades is frankly challenging, especially because of two reasons. One is the common complexity for all the quantitative research, which is data [un]availability. The other one is directly related to our topic. The effect of these shocks could depend on several domestic and unique factors. That makes it difficult to provide more far-reaching explanations, especially if we use quantitative methods. In that sense, this thesis leaves open many other questions that could be interesting for future research. For example, it is necessary to complement our findings with more qualitative studies that allows to have a finer understating of these shocks. Perhaps, methods such as comparative cases could shed more light on their consequences. A further possible line of research is analysing the common conclusion that inflows-driven sudden stops are more costly. Although it could be a fact, there is still no clear answer why they are more disruptive compared to outflow-driven sudden stops. In case of outflow-driven net sudden stops (SSON) and inflow-driven net sudden stops (SSIN), theoretically, there must be and adjustment of the current account. However, they have diametrically different effects on GDP.

In summary, the present thesis has aimed to make three major contributions to the literature on sudden stops. First an updated overview of the main trends of all types of sudden stops worldwide. Second, an analysis of the dynamic consequences of inflow-driven sudden stops. This implied the use of methodological innovations in order to better understand the effect of these shocks over time. Third, an explanation of the transmission mechanism underlying these effects, both in gross and net inflow-driven sudden stops. In general terms, the thesis intended to make a contribution to the understanding of our current world, characterized by deep international financial integration. In particular, our findings set the spotlight on the risks of relying too heavily on international savings to finance investment.

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ANNEX 1: SAMPLE

	Classification	Country	From	To
1	Developed	Australia	1989q1	2021q1
2	Developed	Austria	2005q1	2021q1
3	Developed	Belgium	2002q1	2020q4
4	Developed	Bulgaria	1991q1	2020q4
5	Developed	Canada	1985q1	2021q1
6	Developed	Croatia, Rep. of	1993q1	2020q4
7	Developed	Cyprus	2001q1	2020q4
8	Developed	Czech Rep.	1993q1	2020q4
9	Developed	Denmark	1985q1	2020q4
10	Developed	Estonia, Rep. of	1992q1	2021q1
11	Developed	Finland	1985q1	2021q1
12	Developed	France	1985q1	2020q4
13	Developed	Germany	1985q1	2021q1
14	Developed	Greece	1985q1	2020q4
15	Developed	Hungary	1989q4	2021q1
16	Developed	Iceland	1985q1	2021q1
17	Developed	Ireland	2005q1	2020q3
18	Developed	Italy	1985q1	2021q1
19	Developed	Japan	1996q1	2020q4
20	Developed	Latvia	1993q1	2021q1
21	Developed	Lithuania	1993q1	2021q1
22	Developed	Luxembourg	2002q1	2021q1
23	Developed	Malta	1995q1	2020q4
24	Developed	Netherlands, The	1985q1	2020q4
25	Developed	New Zealand	2000q1	2021q1
26	Developed	Norway	1985q1	2021q1
27	Developed	Poland, Rep. of	2000q1	2020q4
28	Developed	Portugal	1985q1	2021q1
29	Developed	Romania	1991q1	2020q4
30	Developed	Slovak Rep.	1993q1	2021q1
31	Developed	Slovenia, Rep. of	1992q1	2021q1
32	Developed	Spain	1985q1	2020q4
33	Developed	Sweden	1985q1	2020q4
34	Developed	Switzerland	1999q1	2021q1
35	Developed	United Kingdom	1985q1	2020q4
36	Developed	United States	1985q1	2020q4
37	Developing	Afghanistan, Islamic Rep. of	2008q2	2021q1
38	Developing	Argentina	1985q1	2020q4
39	Developing	Bahamas, The	1985q1	2020q4
40	Developing	Bangladesh	1985q1	2021q1
41	Developing	Belize	2001q1	2020q4
42	Developing	Bhutan	2006q3	2020q4
43	Developing	Bolivia	1988q1	2020q4
44	Developing	Brunei Darussalam	2001q1	2020q4
45	Developing	Cabo Verde	1998q1	2021q1

46	Developing	Cambodia	1994q1	2020q4
47	Developing	Chile	1991q1	2020q4
48	Developing	China, P.R.: Hong Kong	1999q1	2020q4
49	Developing	Colombia	1996q1	2021q1
50	Developing	Costa Rica	1999q1	2020q3
51	Developing	Dominican Rep.	2011q1	2020q4
52	Developing	Ecuador	1993q1	2020q4
53	Developing	Egypt, Arab Rep. of	2011q1	2020q4
54	Developing	El Salvador	1999q1	2020q4
55	Developing	Eswatini, Kingdom of	2011q1	2020q4
56	Developing	Ethiopia, The Federal Dem. Rep. of	1985q1	2020q4
57	Developing	Fiji, Rep. of	2000q1	2020q4
58	Developing	Gambia, The	2007q1	2019q1
59	Developing	Guatemala	1985q1	2020q4
60	Developing	Guinea	2009q1	2019q4
61	Developing	Haiti	2004q4	2020q1
62	Developing	Honduras	2004q1	2020q4
63	Developing	India	1985q1	2020q4
64	Developing	Indonesia	1985q1	2021q1
65	Developing	Israel	1985q1	2021q1
66	Developing	Jamaica	2012q1	2020q4
67	Developing	Jordan	1985q1	2020q1
68	Developing	Korea, Rep. of	1985q1	2021q1
69	Developing	Lao People's Dem. Rep.	1994q1	2020q2
70	Developing	Lebanon	2002q1	2019q4
71	Developing	Lesotho, Kingdom of	1985q1	2020q4
72	Developing	Liberia	2010q1	2019q4
73	Developing	Madagascar, Rep. of	2003q1	2020q2
74	Developing	Malaysia	1999q1	2021q1
75	Developing	Mauritius	2000q1	2020q3
76	Developing	Mexico	1985q1	2020q4
77	Developing	Mongolia	1998q1	2021q1
78	Developing	Morocco	2003q1	2020q4
79	Developing	Mozambique, Rep. of	2005q1	2021q1
80	Developing	Myanmar	1985q1	2020q3
81	Developing	Namibia	1999q1	2020q4
82	Developing	Nepal	1985q1	2021q1
83	Developing	Nicaragua	1992q1	2020q4
84	Developing	Pakistan	1985q1	2021q1
85	Developing	Panama	1998q1	2020q4
86	Developing	Papua New Guinea	1985q1	2019q2
87	Developing	Paraguay	2000q1	2020q4
88	Developing	Peru	1991q1	2020q2
89	Developing	Philippines	1985q1	2021q1
90	Developing	Qatar	2011q1	2020q4
91	Developing	Samoa	2003q3	2020q1
92	Developing	Saudi Arabia	2006q1	2020q4
93	Developing	Singapore	1995q1	2021q1
94	Developing	Solomon Islands	2006q1	2020q4
95	Developing	South Africa	1985q1	2020q4

96	Developing	Sri Lanka	1985q1	2020q1
97	Developing	Sudan	1985q1	2019q4
98	Developing	Suriname	2005q1	2020q4
99	Developing	Thailand	1985q1	2020q4
100	Developing	Timor-Leste, Dem. Rep. of	2009q1	2020q4
101	Developing	Turkey	1985q1	2021q1
102	Developing	Uganda	2000q3	2019q4
103	Developing	Uruguay	2000q1	2020q4
104	Developing	Vanuatu	1985q1	2020q2
105	Developing	Venezuela, Rep. Bolivariana de	1994q1	2016q4
106	Developing	Vietnam	1996q1	2020q1
107	Developing	Yemen, Rep. of	2005q1	2016q4
108	Developing	Zambia	2005q1	2021q1
109	Transition	Albania	1995q1	2021q1
110	Transition	Armenia, Rep. of	1993q1	2020q4
111	Transition	Azerbaijan, Rep. of	1999q1	2021q1
112	Transition	Belarus, Rep. of	1996q1	2021q1
113	Transition	Bosnia and Herzegovina	2001q1	2020q4
114	Transition	Georgia	1997q1	2020q4
115	Transition	Kazakhstan, Rep. of	1995q1	2020q4
116	Transition	Kyrgyz Rep.	1993q1	2020q3
117	Transition	Moldova, Rep. of	1994q1	2020q4
118	Transition	Montenegro	2007q1	2021q1
119	Transition	North Macedonia, Republic of	1996q1	2021q1
120	Transition	Russian Federation	1994q1	2020q4
121	Transition	Serbia, Rep. of	2007q1	2020q4
122	Transition	Tajikistan, Rep. of	2002q1	2020q4
123	Transition	Ukraine	1994q1	2021q1
124	Transition	Uzbekistan, Rep. of	2010q1	2020q4