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Net Errors and Omissions in Balance of Payments Statistics

Impacts, causes and effects

Tómas Örn Kristinsson

Dissertation presented as partial requirement for obtaining the Master's degree in Statistics and Information Management

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by

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ABSTRACT

This dissertation researches a discrepancy that is a part of the production of Balance of Payments statistics, i.e. Net Errors and Omissions. The possible causes, potential methods of detection and remedies are discussed. Statistical analysis is used to analyze time series data of most of the countries that adhere to the Special Data Dissemination Standard of the International Monetary Fund. The Net Errors and Omissions item is analyzed, both for randomness, systematic behavior, correlation with other Balance of Payments items, and other major economic variables. Revision histories of all the underlying items of the Balance of Payments and International Investment Position are researched in search for clues of the most common causes of revisions. A survey among the compilers of Balance of Payments Accounts was conducted, asking for their opinions on the potential causes of, and remedies for Net Errors and Omissions. The main conclusions are; that there are cases where there are evidences of systematic behavior of the Net Errors and Omissions, which can indicate a potential for improvement. Financial Account items seem to be more subjected to revisions than those of the Current Account and Capital Account items. The compilers see counter accounting in the double-entry accounting system as the most likely source of errors, and exchanging information amongst themselves across borders as the best way of improving the accounts.

KEYWORDS

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LIST OF ABBREVIATIONS AND ACRONYMS

BOP　　　Balance of Payments as defined by Balance of Payments and International Investment Position Manual.

BPM5　　Balance of Payments Manual, fifth edition (BPM5) issued by the International Monetary Fund 1993.

BPM6　　Balance of Payments and International Investment Position Manual, sixth edition (BPM6) issued by the International Monetary Fund 2009.

CDIS　　Coordinated Direct Investment Survey is a regular survey conducted amongst compilers of Balance of Payments statistics by the International Monetary Fund.

CPIS　　Coordinated Portfolio Investment Survey is a regular survey conducted amongst compilers of Balance of Payments statistics by the International Monetary Fund.

DI　　　Direct Investment.

ESO　　Employee Stock Options.

EUROSTAT　Statistical office of the European Union.

FATF　　Financial Action Task Force is an inter-governmental body established in 1989 to combat money laundering, terrorist financing and other related threats to the integrity of the international financial system. FATF encompasses 35 countries worldwide.[1]

GDP　　Gross Domestic Production.

IIP　　International Investment Position as defined by Balance of Payments and International Investment Position Manual

IIP5　　International Investment Position as defined by Balance of Manual, fifth edition (BPM5) issued by the International Monetary Fund 1993.

IIP6　　International Investment Position as defined by Balance of Payments and International Investment Position Manual, sixth edition (BPM6) issued by the International Monetary Fund 2009.

IMF　　The International Monetary Fund (IMF) is an organization of 189 countries, working to foster global monetary cooperation, secure financial stability, facilitate international trade, promote high employment and sustainable economic growth, and reduce poverty

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[1] http://www.fatf-gafi.org

around the world. Created in 1945, the IMF is governed by and accountable to the 189 countries that make up its near-global membership.[2]

OECD Organisation for Economic Co-operation and Development is an organization of 35 states that has the aim to promote policies that will improve the economic and social well-being of people around the world.

OI Other Investment.

PI Portfolio Investment.

SDDS Special Data Dissemination Standard is a framework set up by the IMF for providing standardized economic and socio-economic information from the subscribers on a regular basis with summary descriptions of methodology, including descriptions of deviations from international guidelines.[3]

SDDS+ Special Data Dissemination Standard Plus is based on SDDS, but with additional categories of information and is targeted on countries that have systematically important financial sectors that are integral to the working of the international monetary system.[4]

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[2] http://www.imf.org/external/about.htm
[3] See: http://dsbb.imf.org/Pages/SDDS/Overview.aspx
[4] See: http://dsbb.imf.org/Pages/SDDS/Overview.aspx?sp=y

1. INTRODUCTION[5]

Balance of Payments statistics have been an intrinsic part of national accounts for most countries in the world since the end of the Second World War. The purpose of the Balance of Payments is to account for flows of trade, services, transfers, funds and financial transactions from all economic actors in one country against other countries. Balance of Payments is accompanied by International Investment Position which measures the assets and debts of the economic actors of one country against other countries.

Net Errors and Omissions in the Balance of Payments accounts is an item that has not received much attention in public discussions and is often misunderstood. The name of the item may be interpreted as to imply mistakes and improper handling of data, whereas, the item is a discrepancy in the double-entry accounting system that reflects the very complex nature of the statistical reconciliation of the many individual components that make up the Balance of Payments accounts. Net Errors and Omissions represent the discrepancy between the Financial Account minus the sum of Current and Capital Accounts. In theory there should not be a discrepancy but, in practice, Net Errors and Omissions can reach substantial amounts that skew the interpretation of flows between different countries. The causes of the discrepancies are often not known but in some instances explanations emerge later, which prompt the revision of the statistics. The subject of the dissertation is to research this discrepancy, i.e. Net Errors and Omissions.

Each component in the Balance of Payments accounts has to be balanced on both the debit and the credit side. In many cases this is straight forward, such as when importing one simple item from abroad and paying for it with a simple bank transfer, which results in one debit and one credit transaction in the Balance of Payments ledger. However, the complexities can increase dramatically when, for example, a company, which is partly owned by non-residents, imports an airplane which is being built abroad and will be delivered in two years' time. During the airplanes manufacturing process, a variety of stage payments could be made resulting in Balance of Payments transactions under loans and/or leases, which have implied costs and interest payments. All of this can occur at different periods in time, can change hands between foreign and domestic participants during the process and can stretch on for years to come. Obtaining reliable and timely information about such transactions, about all the relevant participants, timings and details can be a daunting task and then there can be restrictions on information access and deadlines that complicate the process even further. That sort of a problem is what usually causes Net Errors and Omissions, not dumb mistakes and disorderly usage of data.

This subject seems not to have received much attention in academic literature. Several articles have been written that research capital flight or money laundering by evaluating Net Errors and Omissions, e.g. (Adetiloye, K. A., 2012; Altinkaya & Yucel, 2013; Cuddington, 1986; Eggerstedt, Hall, & Wijnbergen, 1993; Hermes, Lensink & Murinde, 2002). There are several studies on the theoretical and practical aspects of Net Errors and Omissions (Cencini, 2005; Damia & Aguilar, 2006; Kilibarda 2013; Tang 2009, 2013). There are also studies that take a limited view on the effects of revisions

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[5] The views expressed in this dissertation are those of the author's and not necessarily the views of the Central Bank of Iceland.

(Tsz-lim & Kin-cheong, 2010; Kuussaari 2013). There is even a study that provokes discussions on controversial subjects, such as possible falsifying of economic data (Michalski & Stolz, 2012).

1.1. OBJECTIVES AND RESEARCH QUESTIONS

The main objective of this research is to study the Net Errors and Omissions from a statistical perspective and the viewpoint of the compilers of the Balance of Payments accounts.

The project aims at answering the following research questions:

- Is it possible to isolate the main causes of Net Errors and Omissions from the revision history of published data?

- Do the results, of the research from published data, resonate with the suggested causes as put forward in the BPM6, and do these causes reflect what the official producers of Balance of Payment statistics believe to be the main causes of Net Errors and Omissions?

- To how large a degree do Net Errors and Omissions exhibit classical behavior of errors in the statistical perspective (randomness, seasonality or trends)?

- Does the development of magnitude of Net Errors and Omissions relate to major economic indicators (other Balance of Payments items, International Investment Position items, exchange rates, GDP, price levels, wage levels, production and such, and do they correlate with other countries' Net Errors and Omissions)?

1.2. DATA AND METHODS

The main source for Balance of Payments information is the Balance of Payments and International Investment Position Manual, 6th ed. (BPM6). The manual includes a chapter on the Net Errors and Omissions, which explains the issue and the potential sources of the error and how it impacts the Balance of Payments and International Investment Position. There are some general speculations in the BPM6 manual on the causes for Net Errors and Omissions, which this work will try to support or debunk with evidence from research. Furthermore there are areas that are of interest, such as the statistical behavior of this discrepancy and the perceived reasons by the producers of the statistics.

The research is done in three separate steps: review of available literature, statistical research on a database of published data from all the countries that adhere to the Special Data Dissemination Standard, and a survey from a sample of the above mentioned countries.

The review of literature involved searching libraries and the internet for articles and books on the subject. The web sites of IMF, OECD, World Bank, European Central Bank, EUROSTAT and EconPapers were important sources of material as well as Google and Bing search engines.

The statistical testing for researching the univariate characteristics of Net Errors and Omissions was done in two parts, testing for randomness by applying several methods as explained in chapter 4.2.1 and by testing for seasonality as explained in chapter 4.2.2, and evaluating trends (chapter 4.2.3). The multivariate characteristics were evaluated mostly by calculating the correlation of Net Errors and Omissions series for individual countries, and between individual countries (chapter 4.3.1), calculating correlations with individual Balance of Payments and International Investment Position

items (chapter 4.3.3.1), correlations with exchange rate changes (chapter 4.3.3.2), and correlations of Net Errors and Omissions with major economic variables for each country (chapter 4.3.3.3). Microsoft Excel, JDemetra+, and the R package were used for calculations.

The research of revision histories was conducted by querying a SQL database of IFS data (see chapter 4.1) and calculating frequencies (chapter 4.4.2.1), magnitudes (chapter 4.4.2.2) and timings (chapter 4.4.2.3) of revisions to individual items of Balance of Payments and International Investment Position for each country and correlating these with Net Errors and Omissions. Microsoft Excel and the R package were used for calculations.

A survey was conducted using Google Forms amongst all the SDDS and SDDS+ countries that provided contact information in the IFS database. The results of the survey were aggregated using Microsoft Excel.

Data for the numerical studies was mostly obtained from the International Monetary Fund's IFS database[6] and World Bank data[7].

1.3. DOCUMENT STRUCTURE

The dissertation is split into three main sections:

1. An introduction of the Balance of Payments system of accounts.
2. An overview of Net Errors and Omissions as an individual item, explaining the concept, reviews of the available literature on the subject, and an attempt to create an informal handbook on the causes, detection methods and potential remedies for Net Errors and Omissions.
3. Research into the statistical properties of Net Errors and Omissions, which is in two parts, an evaluation of univariate and multivariate characteristics of Net Errors and Omission, and a study of revision histories of the items that make up the Balance of Payments and International Investment Position accounts. Finally, a survey that was conducted amongst the Balance of Payments statistics compilers is presented.

Five appendices with detailed results of tests and other information are in the last section of this dissertation.

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[6] http://www.imf.org/en/Data
[7] http://data.worldbank.org/

2. BALANCE OF PAYMENTS SYSTEM

Balance of Payments is an accounting system that measures the flow of goods, services and finance between one economy against all others. The two sections below describe the development of the accounting system since 1948 and how it fits into the wider framework of national accounts.

2.1. A BRIEF HISTORY OF THE MANUALS' DEVELOPMENT

The first manual on Balance of Payments statistics was published in 1948 by the International Monetary Fund. The manual was based on earlier work done by the League of Nations, which was an attempt to standardize the production of these statistics (International Monetary Fund 1948). The Bretton Woods agreement of 1944, see Bordo (1993) required the countries that participated to furnish information about: "International balance of payments, including (1) trade in goods and services, (2) gold transactions, (3) known capital transactions, and (4) other items." (Section 5 vi, United Nations Monetary and Financial Conference, 1944).

The first edition of the manual consisted of one summary table on Balance of Payments and eleven supplementary tables with further breakdowns of the 16 main items in the summary table. Errors and Omissions are introduced as a balancing item between Current Transactions and Movement of Capital and Monetary Gold. The manual had no further explanation, nor definition of Errors and Omissions. (International Monetary Fund, 1948).

The second edition was issued in 1950 and contained minor changes to the tables, but added significantly to the instructions and guidance notes, with appendices on geographic classification, abbreviated Balance of Payments schedule, with instructions on methodology, and compensatory official financing (International Monetary Fund, 1950). The manual included a short section on Errors and Omissions explaining that even though the double-entry system should balance there might be some transactions that might be inaccurately recorded or not recorded at all, "an *errors and omissions* item has been included in the standard schedule to bring the statement into balance" (International Monetary Fund, 1950, pp. 6-7). The manual also has a chapter on: *Problems of Classification* that indicates potential pitfalls and discrepancies in the accounting and reconciliation of numerous items in the Balance of Payments (International Monetary Fund, 1950, pp. 7-8).

The third edition was issued in 1961 and added explanations of the rationale behind the categories employed and attempted to explain more fully the basic principles and the accounting principles. A simple structural change is introduced by splitting up the current transactions into two categories: *Goods and Services* and *Transfer Payment*. The manual more thoroughly addressed the handling of problematic areas in preparing the Balance of Payments statistics, such as definitions, imputation, exceptions to general principles, changes in valuation and coverage, all of which can lead to discrepancies in the accounts. It also explained the differences of recording exchange transactions between different systems and clarified the linkages to other social accounts, such as national accounts and UN standards of external trade statistics, and differences where known. (International Monetary Fund, 1961). For example, the difference between the double-entry accounting of Balance of Payments against the quadruple-entry accounting in the National Accounts (International Monetary Fund, 1961, pp. 14-15). The use of Balance of Payments as an independent source of checking the consistency of production, consumption and investment in National Accounts is also

pointed out (International Monetary Fund, 1961, pp. 16). The concept: *Errors and omissions* are changed to *Net Errors and Omissions* to reflect the likelihood of debit and credit errors that are mutually offsetting, thus reducing the discrepancies (International Monetary Fund, 1961, pp. 25). The chapter on Problems of classification is expanded considerably in this edition of the manual with additional chapters on *Problems of valuation* and *Problems of conversions* (International Monetary Fund, 1961, pp. 29-34).

The fourth edition of the manual was issued in 1977 in the wake of the breakdown of the Bretton Woods agreement. Some structural changes were made, such as the reorganization of the *Capital Account* by splitting it into two categories: *Capital* and *Reserves*, and identify *Portfolio Investments* as a separate item. The explanatory material was rewritten and expanded considerably and a separate chapter on analytic presentation was added. The valuation concept is given a separate chapter in order to explore the difficult problems that it invokes. (International Monetary Fund, 1977). The manual introduces a new rule of thumbs for evaluating the effects of Net Errors and Omissions on the interpretation of the accuracy of the statements, i.e.: "An empirical rule of thumb that is sometimes quoted holds that a residual is large enough to create a problem when it exceeds the equivalent of 5 per cent of the gross credit and debit entries for merchandise combined (although the residual can also arise, of course, from nonmerchandise transactions)" (International Monetary Fund, 1977, pp. 62).

The fifth edition of the manual, issued in 1993, introduced a major addition in the form of *International Investment Position*. Balance of Payments only relate to transactions during a set time period, whereas the International Investment Position accounted for external stock position of assets and liabilities that changed due to the aforementioned transactions, with the addition of accounting for valuation changes and other adjustments that were not measured previously. Apart from these changes the manual further aligned the Balance of Payments statistics with the *System of National Accounts 1993*. Which were revised in a coordinated effort (International Monetary Fund, 1993). Some of the changes made to the manual were the: "result of the liberalization of financial markets, innovations in the creation and packaging of financial instruments, and new approaches to the restructuring of external debt. In addition, there has been unprecedented growth in the volume of international trade in services. All these developments have necessitated changes in the treatment and classification of such transactions within the structure of the balance of payments accounts" (International Monetary Fund, 1993, pp. xi). Among other changes, the Current Account of the Balance of Payments was redefined to exclude Capital Transfers, which were moved under an augmented category of: Capital and Financial Account, and clear distinctions were made among goods, services, income, and current transfers (International Monetary Fund, 1993, pp. xi). The manual drops the rule of thumbs on hampering effect of Net Errors and Omissions, which was introduced in the previous manual. (International Monetary Fund, 1993, pp. 38). The fifth edition was accompanied by a very comprehensive compilation guide that was published in 1995 (International Monetary Fund, 1995).

The sixth and current edition of the manual was issued in 2009 and its title included the international investment position. Some of the most significant changes from the previous edition related to: "Revised treatment of goods for processing and goods under merchanting; changes in the measurement of financial services […]; elaboration of direct investment […]; the introduction of the concepts of reserve-related liabilities, standardized guarantees, and unallocated gold accounts; new

concepts for the measurement of international remittances; increased focus on balance sheets and balance sheet vulnerabilities […]; strengthened concordance with the SNA […]; and extensive additions to the Manual […]." (International Monetary Fund, 2009, pp. xii-xiii). The manual includes a short chapter on Net Errors and Omissions where the potential effects of net pluses or minuses are distinguished. The manual also encourages producers to analyze the item to help shed light on data problems, such as coverage or misreporting, as well as patterns that could indicate biases (International Monetary Fund, 2009, pp. 11).

2.2. STRUCTURE

Balance of Payments is an accounting system that measures the flow of goods, services and finance between one economy against all others, which can be referred to as residents against non residents. The system is based on double-entry accounting, which means that there is a debit entry and a corresponding credit entry. As in all accounting systems, one transaction may lead to many entries into different accounts. A relatively new and a welcome change in the latest edition of the manual is that netting of categories is more or less abandoned, which gives a more comprehensive account of the values within each category.

The current system (BPM6) has three main components: Current Account, Capital Account and Financial Account. Each of these is divided into several sub-accounts and together the Current Account and Capital Account should sum up to equal the Financial Account. However, in practice that equality is rarely achieved, leading to a discrepancy named: Net Errors and Omissions. Furthermore, the Balance of Payments accounts complement to a large extent the International Investment Position, which measure the stock of the various assets and liabilities that result from the transactions recorded in the Financial Account along with other changes, such as other volume changes and revaluation changes. Figure 2.1 below shows the main sub-accounts and interlinkages. (International Monetary Fund, 2009).

Overview of International Accounts			
Balance of payments	Credits	Debits	Balance
Current account			
Goods and services	540	499	41
Goods	462	392	70
Services	78	107	-29
Primary income	50	40	10
Compensation of employees	6	2	
Interest	13	21	
Distributed income of corporations	17	17	
Reinvested earnings	14	0	
Rent	0	0	
Secondary income	17	55	-38
Current taxes on income, wealth, etc.	1	0	
Net nonlife insurance premiums	2	11	
Nonlife insurance claims	12	3	
Current international cooperation	1	31	
Miscellaneous current transfers	1	10	
Adjustment for change in pension entitlements			
Current account balance			13
Capital account			
Acquisitions/disposals of nonproduced nonfinancial assets	0	0	
Capital transfers	1	4	
Capital account balance			-3
Net lending (+)/net borrowing (–) (from current and capital accounts)			10

Financial account (by functional category)	Net acquisition of financial assets	Net incurrence of liabilities	Balance
Direct investment	8	11	
Portfolio investment	18	14	
Financial derivatives (other than reserves) and ESOs	3	0	
Other investment	20	22	
Reserve assets	8	0	
Total changes in assets/liabilities	57	47	
Net lending (+)/net borrowing (–) (from financial account)			10
Net errors and omissions			0

International investment position	Opening position	Transactions (Fin. Acc.)	Other changes in volume	Revaluation	Closing Position
Assets (by functional category)					
Direct investment	78	8	0	1	87
Portfolio investment	190	18	0	2	210
Financial derivatives (other than reserves) and ESOs	7	3	0	0	10
Other investment	166	20	0	0	186
Reserve assets	833	8	0	12	853
Total assets	1,274	57	0	15	1,346
Liabilities (by functional category)					
Direct investment	210	11	0	2	223
Portfolio investment	300	14	0	5	319
Financial derivatives (other than reserves) and ESOs	0	0	0	0	0
Other investment	295	22	0	0	317
Total liabilities	805	47	0	7	859
Net IIP	469	10	0	8	487

Note: ESO = employee stock option.

(International Monetary Fund 2009, p. 14)

Figure 2.1 - Overview of International Accounts (Based on Table 2.1. in BPM6, pp. 14)

2.3. RELATIONSHIP WITH OTHER STATISTICAL SYSTEMS

Balance of Payments and International Investment Position statistics have evolved in the course of the last decades and are now almost fully harmonized with the *System of National Accounts*, which is an international system that has been set up in cooperation amongst various international and national organizations under the leadership of the United Nations. Figure 2.2 below (Figure 1.1 in the BPM6) shows the relationships with the various components of the international accounts and national accounts. (International Monetary Fund, 2009).

Figure 2.1. Overview of the *System of National Accounts* as a Framework for Macroeconomic Statistics Including International Accounts

Transactions/Balance of payments:

Goods and services account

Production account
Value added/GDP

Other flows:

Generation of income account
Operating surplus

Distribution of income account
National income

Secondary distribution of income account
Disposable income

Use of income account
Saving

Opening balance sheet	Accumulation accounts		Closing balance sheet
Nonfinancial assets	**Capital account**	Other changes in nonfinancial assets	*Nonfinancial assets*
	Net lending/net borrowing		
Financial assets and liabilities	**Financial account**	Other changes in financial assets and liabilities	*Financial assets and liabilities*
Net worth	Net lending/net borrowing	Net other changes	Net worth

Key:

Name of account
SNA Balancing item

Shaded accounts do not appear in the international accounts.
The arrows represent the contributions of assets to production and income generation (e.g., using nonfinancial assets as an input to production, using financial assets to generate interest and dividends).

Figure 2.2 - Overview of the Framework for Macroeconomic Statistics (BPM6, pp. 8)

The BPM6 also complements work by the Organization for Economic Co-operation and Development (OECD) *Benchmark Definition of Foreign Direct Investment*. (International Monetary Fund, 2009, pp. xi).

3. NET ERRORS AND OMISSIONS

Net Errors and Omissions refer to a discrepancy in the accounting of Balance of Payments statistics. This discrepancy rises due to several reasons, some of which are quite apparent, whereas some are more hidden. The term *Errors* indicates incorrectly recorded items and *Omissions* refers to missing items. In most discussions, no clear distinction is made between the *Errors* and the *Omissions* items, thus, the term is used as a collective term. Below is an attempt to detail the different facets of the concept, ranging from definition of the term, review of the somewhat limited literature that has been published on the subject, attempt at categorizing the possible errors, how they can be detected and what remedies can be used to minimize or eliminate them. A statistical analysis of historical data on Net Errors and Omissions of most of the countries that subscribe to SDDS and SDDS+ is presented. The analysis focuses on statistical attributes of Net Errors and Omissions and relationship with other economic metrics.

3.1. DEFINITION OF NET ERRORS AND OMISSIONS

The sixth edition of the Balance of Payments manual does not formally define the term of Net Errors and Omissions, only saying: "Although the balance of payments accounts are, in principle, balanced, imbalances result in practice from imperfections in source data and compilation. This imbalance, a usual feature of balance of payments data, is labeled net errors and omissions and should be identified separately in published data. It should not be included indistinguishably in other items. Net errors and omissions are derived residually as net lending/net borrowing and can be derived from the financial account minus the same item derived from the current and capital accounts." (International Monetary Fund, 2009, pp. 11). One paper refers to Net Errors and Omissions as "The Balancing Item" (Duffy, M., & Renton, A., 1971). The World Bank defines Net Errors and Omissions on its web page[8] as follows: "Net errors and omissions constitute a residual category needed to ensure that accounts in the balance of payments statement sum to zero. Net errors and omissions are derived as the balance on the financial account minus the balances on the current and capital accounts." Others, such as OECD define Net Errors and Omissions in the following manner: "Labeled by some compilers as a balancing item or statistical discrepancy, that item is intended as an offset to the overstatement or understatement of the recorded components." With the added explanation: "Some of the errors and omissions may be related to recommendations for practical approximation to principles".[9] Kilibarda (2013), argues that: "The essence of the Net errors and omissions position is finding the cause of its existence and pointing the search for anomalies in the right direction rather than reducing its value to zero." (Kilibarda, B., 2013 pp. 10). Fausten & Pickett (2004) define *Errors* as incorrectly recorded transactions and *Omissions* as transactions that are not recorded at all. "Its particular value is generated by the accounting conventions of double-entry bookkeeping". (Fausten, & Pickett, 2004, pp. 1303)

The key words or phrases in the definitions in the previous paragraph appear to be: Balancing Item; Discrepancies; Residual; Imperfections; Incorrectly Recorded; Not Recorded; and Double-entry Accounting.

The proposed definition is therefore:

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[8] data.worldbank.org/indicator/BN.KAC.EOMS.CD. Retrieved 29.5.2016
[9] https://stats.oecd.org/glossary/detail.asp?ID=166. Retrieved 29.5.2016

Net Errors and Omissions are a balancing item in Balance of Payments, derived from the total value of the Financial Account minus the combined total value of the Current and Capital Accounts that stem from discrepancies that are due to incorrectly recorded or missing items in the double-entry accounting system.

3.2. REVIEW OF LITERATURE

Since 1948 when Balance of Payments Accounts were first introduced, Errors and Omissions have been a part of the accounts. Little attention was paid to this item at first as it only functioned as a balancing item of the accounts. The economies were also simpler and more easily observable shortly after the Second World War and in many countries official controls or interventions were accepted in international trade, often due to shortages of basic goods and limited access to funds or simply due to the governance structure in the individual countries. As sophistication grew and International Accounts received more attention and fuller understanding, more demands were made and focus also shifted to nuances and the more obscure items of the accounts. Therefore, more has been written on Net Errors and Omissions as time has passed, than in the early days. Furthermore, interpretation of the meaning of large deviations in the Net Errors and Omissions have taken into account many facets that are difficult to measure, such as unrecorded capital flows, e.g. capital flight, unrecorded goods flows, e.g. smuggling and workers' remittances. The technical issues have also received attention, such as availability and usefulness of measurement tools, accuracy of evaluation methods, and the appropriateness of the production methods. Focus has also been on how to increase the accuracy of the production and the usage of intrinsic methods, such as statistical analysis of the data and comparison, such as asymmetries between published numbers by individual countries. In some cases the analysis has been done by international or national institutions involved in the production of Balance of Payments, but users of these statistics and academics have also participated in the discussions.

3.2.1. Causes and Quality Issues

The Balance of Payments manuals offer numerous valuable insights into the causes for Net Errors and Omissions, from pointing out the obvious relationships, such that if Net Errors and Omissions are positive that may stem from credits in the Current and Capital Accounts being too low or vice versa the debits being too high, etc. (International Monetary Fund, 2009, pp. 11), to the more sophistic reasons as how differences in the time of recording by partner economies can lead to serious distortions (International Monetary Fund, 2009, pp. 39). As many of these will be subject to discussions in the subsequent chapters, it serves no purpose to dwell on these in the current section. Chapter 17 in the *Balance of Payments and International Investment Position Compilation Guide* deals with quality issues of Balance of Payments and will be referred in the subsequent chapters, as well as other chapters in the compilation guide where appropriate. (International Monetary Fund, 2014).

3.2.1.1. General Literature

The first major attempt at researching discrepancies in Balance of Payments was sponsored by the IMF in 1987, when a *Report on the World Current Account Discrepancy* was issued. Increasing discrepancies in the current account of many countries prompted the formation of a task force that researched thoroughly the causes of observed discrepancies and gave recommendations on how to

remedy the problems. The study focused on Current Items, such as Investment Income, Shipping and Transportation, Unrequited Transfers, and looked into geographical allocations. The task force found out that a mismatch in accounting for Investment Income Account by debtor countries versa creditor countries explained a substantial share of the discrepancies. As the debtor countries had much better overview of their positions than the creditors, the recommendation was to use available sources by international bodies to estimate, especially Interest Rate Income for Portfolio Investment. Also better treatment of Reinvested Earnings was suggested. Shipping and Transportation was another area of inconsistencies. However, as the situation seemed to be rather stable and involve fleets of a limited number of countries (although important ones) recommendations were made on improvements in reporting and estimation methods where these were lacking. The task force recommended that further work should be undertaken to improve the treatment of Unrequited Transfers. The task force noted several problems in the geographical allocation of certain items, such as investment and services. In most cases this had no effect on the final results, but industrial countries and in some cases international institutions were identified as the most likely sources of incomplete information. (International Monetary Fund, 1987).

In their paper, Blomberg, Forss & Karlsson (2003), discuss the various aspects for minimizing Net Errors and Omissions, the most important being the limitations that it poses on correctly describing and analyzing contents and allocations of net financial savings. They also stress the importance of high quality statistics as these are used in National Accounts, for evaluating foreign trade, direct investments and the exchange rate. (Blomberg, Forss & Karlsson, 2003, pp. 43).

Cencini (2003) looked into the "missing surpluses" that Krugman and Obstfeld discuss in their 2003 textbook: *International Economics. Theory and Policy*.[10] Cencini suggests that the reason lies in two connected items, unrecorded capital flight and lack of reporting of Net Interests paid on debt by debtor countries. (Cencini, 2005)

In his working paper, Kilibarda (2013), studied the various aspects of Net Errors and Omissions and then examined the Balance of Payments items in his country Montenegro in that light. He observed that significant omissions can cancel out due to the double-entry accounting system and possible failures in reconciling large transactions. He argued that rather than attempting to reduce Net Errors and Omissions to zero the object should be to use it to search for the anomalies that cause the discrepancy. (Kilibarda, 2013, pp. 43).

Committeri (2000) stresses that compilers should pay much attention to reconciliation adjustments as these "are a part of the data validation process through which national compilers can "explain" how IIP and BOP statistics are related and show that the two sets of data have been cross-checked and their accuracy verified. Second, such adjustments provide the analyst with a means to assess the ex post exposure of a country to valuation changes on both the asset and liability sides." (Committeri, 2000, pp. 3). He advocates for increase of the amount of financial information when compiling Balance of Payment and International Investment Position as volatility of price and exchange rates affects the accuracy of the accounts, i.e. using fixed price or exchange rates for each period introduces errors and complicates reconciliation with other sources. (Committeri, 2000, pp. 24).

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[10] Incidentally this term is not used in the 9th. Ed. of the book, issued in 2012.

3.2.1.2. Unrecorded Capital Flows

Capital flight contributes to unrecorded Capital Flows, but it is a complex issue and there is no generally accepted definition or measurement method (e.g., Calvo, 2016; Cumby & Levich (1987); Dooley, 1986, 1988; Kant, 1996).

Cuddington (1986) examined the negative effects of capital flows on economies in his 1986 article. He observed that "Some forms of capital flight, such as smuggling or under invoicing of exports and over invoicing of imports, do not even show up in 'errors and omissions'". Cuddington's method is sometimes referred to as "Hot Money". (Cuddington, 1986, pp. 3).

Dooley (1988) presents a framework for evaluating capital flight by using interest rate and inflation differential and risk premiums between countries.

Schineller (1997) researches the drivers for capital flight using an econometric model with long time-horizon and panel data. The study identifies the "importance of the government's budget surplus as a potential determinant of capital flight" (Schineller, 1997, pp. 20).

By using statistical methods and models it is shown that unrecorded capital flows into the Nigeria are found to partly explain large Net Errors and Omissions Item (Adetiloye, 2012).

In many countries the reverse problem (that of large unrecorded outflows) poses a problem in the Balance of Payments Accounts, such as Mexico (Eggerstedt & Wijnbergen, 1995) who found that using Net Errors and Omissions and short-term asset changes did not relate well with the unreported private accumulation of foreign assets.

Hermes, Lensink & Murinde (2002) researched South Asia, East Asia, Sub-Saharan Africa and Latin America and attempted to use Net Errors and Omissions in their models to estimate capital flight concluding that it was "conceptually wrong" to use models (*Dooley* and *Hot Money*) based on Net Errors and Omissions (Hermes, Lensink & Murinde, 2002, pp. 6).

In Russia, where it was noted that Net Errors and Omissions were negative for 12 consecutive years apart from one year in a period which was suspect for large illegal capital flows (Loungani, & Mauro, 2001)[11].

Shi & Lian (2014) concluded that, based on models using Net Errors and Omissions in China there was a case for encouraging the government entities to strengthen their surveillance of capital flows. (Shi & Lian, 2014).

Geng (2004) examines round tripping of capital in China and estimates that around 40% of Foreign Direct Investment is originated within the country, but via hidden transmissions through other countries, leading to higher Net Errors and Omissions. (Geng, 2004).

Blomberg, Forss & Karlsson (2003) state that Individual households' investments directly abroad (not via a local intermediary) in the form of, for instance, stocks, shares or bank deposits, are only captured to a very minor extent. They also mention incomplete coverage of securities trading across

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[11] Chapter 4 in the book is authored by Akira Uegaki

borders and banking sector transactions abroad, which are often not reported timely. (Blomberg, Forss & Karlsson, 2003, pp. 48).

Brada & Tomšík (2003) discuss controversies about "rules of thumb" regarding certain items in Balance of Payments which are thought to indicate financial crisis, such as the one saying that Current Account deficit should not exceed 5% of GDP. They observe that an anomaly in the imputation of reinvested profits of the subsidiaries of foreign firms, which involves no transactions can overstate the Current Account deficit which might trigger warning signs according to the rules of thumb. They also see this happening in several transition economies. (Brada, Tomšík, 2003 pp. 2-4).

Ndikumana, Boyce & Ndiaye (2006) evaluate capital flight in 39 African countries, mostly Sub-Saharan countries, using the residual method advised by Cuddington (1986), which was developed at the World Bank and which "defines capital flight as a residual, the difference between recorded inflows and recorded uses of foreign exchange". (Ndikumana, Boyce & Ndiaye, 2006 pp. 5). They identify trade misinvoicing and unrecorded workers' remittances as important sources for errors, but they distinguish between; Funds acquired illegally; funds transferred abroad illegally; and funds held abroad illegally as illegal Capital Flow. (Ndikumana, Boyce & Ndiaye, 2006 pp. 14-15). They also categorize a number of factors as drivers of Unrecorded Capital Flows, such as: Structural, i.e. governance and lack of management capacity; Macroeconomic environment; Risk and returns to private investment and portfolio choice; Capital account regime and financial regulation; External borrowing; Political factors; and Hysteresis and habit formation, where corruption trickles down the economy from highest rungs in the political ladder. Their most conclusive results point to external borrowing as a common factor, but other results, such as abuse of natural resources endowments is more dependent on the political landscape. (Ndikumana, Boyce & Ndiaye, 2006).

3.2.1.3. Unrecorded Goods Transactions

Smuggling and money laundering have probably followed human history since the first attempts to regulate and tax goods transactions across borders. These are complex issues, which have social order implications as well as financial. Authorities try to counteract by establishing border controls, financial intelligence units and other measures designed to shed light on the problem and find ways to fight against the illegal activities, (e.g. Pitt, 1984; Unger, Siegel & Ferwerda, 2006).

Altinkaya & Yucel (2013) examine the effects of money laundering on trade in Turkey, where they infer that "… certain amount of money laundering could be forecasted under the net errors and omission of balance of payments of Turkey" (Altinkaya & Yucel, 2013, pp. 123), citing research of Aktaş & Altan (2013) on the possible effects of surveillance mechanism on over invoicing trade across borders. By using mirror statistics they estimate that in 2011 import figures were overstated by 2-3 billion USD. (Aktaş & Altan, 2013). They also refer to research by Blades & Ivanov (1983) who classify three possible sources of discrepancies in trading accounts, a) inevitable differences, for example "free on board" vs "cost insurance and freight" accounting, which can lead to up to 10% differences in mirror statistics, b) structural differences, for example different methodology between countries in compiling or accounting for exchange rates, c) errors, such as negligence, fraud or in statistical methods.[12] (Blades & Ivanov, 1983).

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[12] This paper is in French, which this author does not comprehend, therefore, summarizing from (Aktaş & Altan, 2013, pp. 3-4)

Another important source of potential errors due to unlawful activities are reports from Financial Action Task Force (FATF), where some of the most important causes for misrepresentations of trade statistics are listed, such as: over- and under-invoicing of goods and services; multiple invoicing of goods and services; over- and under-shipments of goods and services; and falsely described goods and services. (FATF, 2006). There are also number of recommendation from FATF on how to combat these problems, such as comparisons between countries, manufacturers, importers/exporters, origin, descriptions, tax remittances and more, also using statistical analysis on import/export data to search for discrepancies. (FATF, 2008).

Blomberg, Forss & Karlsson (2003) point to overestimation of Net Export of Goods within the European Union (EU) which are well known and have resulted in a systematic overestimation of Exports. (Blomberg, Forss & Karlsson, 2003, pp. 47).

3.2.1.4. Worker's Remittances

Worker's Remittances are a cross cutting issue in the current account, touching on primary and secondary income accounts as well as indirectly on goods and services account. As this item has been growing in importance with more flexibility of workers, more attention has been payed to its effects on Balance of Payments and how it can affect Net Errors and Omissions.

Cali, & Dell'Erba (2009) question the methodologies of the World Bank regarding their estimations of the drop of workers remittances after the 2008 financial crisis, believing these estimates understate drop by substantial amounts. They attempt to create a more accurate model for estimating remittances that would rectify the estimates. They point out potential errors in estimating remittances, such as measurement problems due to informal channels of repatriation and changes that can occur in the practices over time. They also mention that different methods are used to evaluate inflows and outflows of remittances. (Cali, & Dell'Erba, 2009).

Freund & Spatafora (2005) use historical data from different sources to investigate remittances that are transferred via informal channels. Their conclusion is that these are underestimated in official statistics by as much as 35-75%, although, substantial differences can be across different regions. (Freund & Spatafora, 2005).

Reinke (2006) gives a very comprehensive summary of issues related to remittances, such as definitions, practices for compilation and dissemination as well as suggesting plans for improved compilation guidance. (Reinke, 2006).

3.2.2. Technical Aspects

Blomberg, Forss & Karlsson (2003) distinguish different types of measurement errors i.e.: Coverage errors, which could be called omissions; Measurement errors (evaluation errors), where there are deficiencies due to definitions or other technical treatment, and; Time errors (periodization errors), where transactions are reported for the wrong period of time. They also caution against interpreting small reported Net Errors and Omissions as a better measure of the statistics, as counter-balances can cancel out significant differences. (Blomberg, Forss & Karlsson, 2003, pp. 43).

They also debate the different comparisons e.g. *Errors and Omissions as a percentage of GDP, Errors and Omissions as a percentage of Gross Flows regarding Current Account Balance and Capital*

Balance and Errors and Omissions as a percentage gross flows of Basic Balance (Basic balance being Current Account, Capital Balance, Direct Investment and majority of Securities Trading). (Blomberg, Forss & Karlsson, 2003, pp. 45-46).

Ghosh (1997) sites methodologies of Mankiw et al. (1984) and Mork (1990) to investigate the nature of revisions. Mankiw et al. (1984) classify errors as "classical measurement errors" and "efficient forecast errors", and Mork (1990) suggests an alternate classification "inefficient forecast errors". The conclusion of the research is that the revisions in the United States trade balance announcements represent measurement errors. (Ghosh, 1997).

Damia & Aguilar (2006) discuss revisions and what their research indicated as promising use of this category. Using five years data they found that revisions had decreased, but in some areas there was a bias, which suggested areas for further study into how to improve Balance of Payments statistics. They found that differences in timing was often the cause of errors, but some were subsequently eliminated by the revisions to data (Damia, & Aguilar, 2006, pp 5).

Duffy & Renton (1971) use principal components analysis to regress the Errors and Omissions against probable major sources of errors and others. Their analysis shows some success in identifying some of the major sources of errors. (Duffy & Renton, 1971).

Fausten & Brooks (1996) researched the Errors and Omissions in Australia with the intention of finding ways to use the item to improve Balance of Payments statistics. Their results were mostly inconclusive and did not lead them to any improvements in results. They also noted that Errors and Omissions had grown substantially, which might justify using scaling, such as GDP to adjust in research. (Fausten & Brooks, 1996).

Tombazos (2003) refuted these (Fausten & Brooks) results several years later as revisions had decreased the Errors and Omissions substantially in the years between. His conclusion was that caution should be applied to initial publications of Balance of Payments statistics. (Tombazos, 2003).

Tang (2013) Found in his study on Australian data that "real GDP, foreign income, foreign interest rate, domestic interest rate, and exchange rate have either directly or indirectly caused EO over the sample period 1960-2010" (Tang, 2013, pp 19-20).

Tang (2009) tested Net Errors and Omissions for linearity and found that some countries exhibited non-linearity, whereas others had linearity, which means that different econometric methods have to be applied when using Net Errors and Omissions in such models.

3.2.3. Remedies

Lane & Milesi-Ferretti (2001) create a model to re-estimate foreign assets in a number of countries based on initial assets position and then accumulating flows of Foreign Direct Investments and Portfolio Investments, adjusted by valuation changes, such as exchange rate movements. They also add inn data about debt reduction, which sometimes include equity swaps. They acknowledge that there are substantial margins for errors, but their conclusions seem to provide an alternate way of cross-checking the existing statistics for consistency. The main problem with this method is a lack of data of sufficient quality. (Lane, & Milesi-Ferretti, 2001).

Six years later Lane & Milesi-Ferretti (2007) revisited the subject, with an improved data base and changed methodology. As their dataset now includes data based on BPM5, they have access to International Investment Position data for 145 countries, which allows for estimating backwards series of capital flows for comparison with official data. Their results in many cases compared well with the official data, but in some cases it revealed large potential underreporting in capital flows. Even though the conclusions aim more at identifying global trends in foreign investments, their methodology can be used for cross-checking investment data. (Lane, & Milesi-Ferretti, 2007).

Salo (2014) describes the success by Finnish authorities in reducing Net Errors and Omissions by analyzing residuals and using it to reevaluate overestimates of foreign portfolio investment liabilities. The article also points out the potential underestimation of external assets, which can be due to limited coverage and in some instances intentional hiding due to tax evading. (Salo, 2014).

3.3. CAUSES OF ERRORS

Broadly speaking errors can be categorized in two groups: Random Errors and Systematic Errors. Random Errors are errors that happen unexpectedly and can or cannot be repetitive. The causes of Random Errors can range from human mistakes to malfunction in machines, which create an incorrect measure. Systematic Errors stem from underlying weaknesses in processes or observation methods, which repeat erroneous measures or create circumstances where these can compound and skew results. Other categorizations of errors are possible, such as Allchin's (2001), who categorizes errors into four categories, i.e. material, e.g. improper procedures or improper samples; observational, e.g. insufficient controls to establish domain of data or observations or incomplete theory of observation; conceptual, e.g. flaw in reasoning inappropriate models; and discoursive, e.g. communication failures: incomplete reporting, obscure publication, translation hurdles, patchy citation/search system or mistaken credibility judgments. (Allchin, 2001, pp. 4). For our purposes the simple categorization of Random and Systematic Errors is used, but Allchin's categories provide an alternative view on the subject, which can aid in understanding the subject.

3.3.1. Random Errors

Random Errors are errors that occur unpredictably, sometimes due to known causes and sometimes not. Many kinds of personal mistakes fall under this type of errors, for example, incorrectly registered number, failure to observe some happening, inattention to detail, etc. Other mistakes, such as occasional wrong categorization and glitzes in computer handling fall under this type of errors. These errors can be hard to spot, but statistical testing can often help in locating and minimizing their effects.

3.3.2. Systematic Errors

Barlow (2002) discusses Systematic Errors in some detail in his 2002 paper: *Systematic Errors: Facts and Fictions.* He cites two widely used definitions, that of Orear: "*Systematic effects* is a general category which includes effects such as background, selection bias, scanning efficiency, energy resolution, angle resolution, variation of counter efficiency with beam position and energy, dead time, etc. The uncertainty in the estimation of such a systematic effect is called a *systematic error*.", and Bevington: "*Systematic Error:* reproducible inaccuracy introduced by faulty equipment, calibration or technique." (Barlow, 2002, pp. 2) in illustrating different understanding and sometimes

misunderstanding of the concept. Systematic Effects are often mistakenly labeled Systematic Errors, and the two definitions are at odds. For our purposes the Bevington's definition is better suited. With the emphasis on *reproducible* or given the same usage of methods, procedures and production technique, systematic errors will reoccur indefinitely; unless discovered and remedied, of course.

3.3.3. New Challenges

Internet trade has radically affected international trade in goods, services and financial products in recent years. Some of the trade can be measured via indirect methods, as goods are usually accounted for in usual manner via custom reports or sampling, whereas payments can be far harder to track due to a variety of new payment methods, ranging from PayPal, which is usually mirrored through credit cards, to Bitcoin, which is virtually untraceable. Complex tax structures can create barriers from observation of the underlying financial flows and positions, as well as uncertainty about treatment of data. Financial engineering often creates products that can be very difficult to value and sometimes hide the final beneficiary from being observed. Innovation in fraud and scheming seems to be without bounds, and if large scale and undetected, it can create substantial unexplained imbalances.

3.4. BALANCE OF PAYMENTS SPECIFIC ITEMS

The BPM6 and compilation guides provide a framework for the production of Balance of Payments statistics. Broadly speaking that should suffice in constructing a system for the production that would fulfill all the requirements for successful production. But, given the complexities involved, due to misalignment of items, for example goods arriving in different proportions and the financing side being interwoven with other items and spread over time, the need for estimations, imputations, and adjustments undermine the implied accuracy and beauty of the system as envisioned by the authors. Complexities of corporate structures, reaching into different regions, often create problems that can require considerable time and effort to untangle.

3.4.1. Current Account

Imperfect measurement methods are usually to blame for inaccuracy in evaluating the volumes and worth of current account items. Given circumstances, the volume of trading of goods can often be measured quite accurately using records created by customs authorities. But sometimes there are no formal customs controls, which complicates matters. On top of that some activity takes place outside official control and can be hard to measure. Intangible items are much harder to measure, such as services and remittances.

3.4.1.1. Goods and Services

Measuring the flow of goods is usually done in two ways, by official recording; where goods traded across borders are accounted for by official control via import/export records, or by conducting surveys with the largest importers/exporters, extrapolating the results on an estimate of the total population. The former method should be more accurate, as surveys frequently suffer from poor responses and problems in maintaining the proper population frame. However, official recording of imports/exports do not account for illegal activity, such as smuggling, and over- or under invoicing. Problems with systems and proper application of methodology may also have negative effects on accuracy. Reconciling import/export information with foreign producers of the same statistics could

yield a different perspective or information on different approaches to data collection. Exchanging information should in theory improve the process substantially. Timing and valuation problems are potential sources of errors. Requesting information about these using survey forms developed by the IMF as suggested in the *BPM6 Compilation Guide* (International Monetary Fund, 2014, pp. 21, and appendices) can aid in resolving these problems.

Services across border are a much greater measurement challenge. Identifying potential sources of information, both directly on the subject and by inference from other material, can be very difficult and require unconventional thinking. Usually surveys are conducted among the parties that are believed to be participating in services that stretch across borders, but identifying the population and then constructing and carrying out a survey demands attention to detail and the use of scientific approach to maximize the chance of successful results. Surveying tourists is an established method of collecting data, but such surveys are hard to control and may yield skewed information. Care must be taken to distinguish between services and goods when requesting data. Careful control mechanism is therefore necessary if useful data information is sought. Surveying banks, credit card companies and other payment intermediaries can provide a secondary source of information that can greatly enhance the data collection. When paradigm shifts take place, such as the emergence of the "sharing/exchanging culture" develops, it throws wrenches into the gears of the established mechanism of collecting information. Attaching monetary value to services, such as "couch surfing" can also create a headache for statistics producers. Depending on the spread of activities some can be safely ignored as inconsequential in the big picture, but others may grow rapidly, thus requiring some accounting for. Contacting the instigators of such services for information might be worth the while, because published information about the activity can raise the profile of the practices and be important in advertising it as an alternative to existing services, and thus mutually benefitting both parties. Chapter 3 in the *BPM6 Compilation Guide* (International Monetary Fund, 2014) presents a variety of advice on the methodology of surveying for information about Balance of Payments and International Investment Position data, as well as presenting templates for survey forms to use in different situations.

3.4.1.2. Primary Income

Primary Income Account involves the following main components: Compensation of employees; Interest; Distributed income of corporations; Reinvested earnings; Rent; and Taxes and subsidies on products and production. Some of these can be accessed via official/semi-official channels, such as tax records, bank data and data from payment intermediaries. Other sources, such as surveys are commonly used to sample the populations affected.

Remittances are frequent subject in literature on Balance of Payments (Cali, & Dell'Erba, 2009; Freund & Spatafora, 2005; Reinke, 2006), reflecting that there are commonly problems with recording accurately information about the subject. Correctly defining employment that is different from services provided by foreign parties can on its own present a problem in many cases, but BPM6 lays down some advice on the subject, which can aid in this matter (International Monetary Fund, 2009, pp. 185). Employment of foreign workers is sometimes connected with illegal or questionable practices, such as slavery of some sort, abuse of workers' rights and underground activities of some sort. This makes it particularly difficult to account correctly for. Cooperation with different official bodies, such as tax authorities, police, health and public services might aid in gaining insights into the

field. Payment intermediaries, such as wire transfer services, and money brokers can be sources of data. If large industries are involved, where the work force is composed of large number of people from different regions or countries, it might be worthwhile to construct a profile of an "average" worker from each region or country, where the main characteristics are captured and then extrapolated on the total workforce. This profile would include wages, taxes, pension payments, remittances, savings, estimated living expenditures and other items needed to successfully account for their effects in the economy. Some of these might be tested or validated against other known sources, such as bank data or transfers of money across borders and tax records. Workers unions, trade associations, and charities can also help in getting information on the magnitude of some practices. As remittances can flow both in and out of the economy, different methods need to be used when measuring inwards and outwards flows. Chapter 3 in the *BPM6 Compilation Guide* (International Monetary Fund, 2014) has a number of suggestions and model forms for surveys on how to collect data about remittances.

Interest paid or collected across borders is an important item in primary income. Interest can be thought of as rent for capital and thus represents the cost or revenue of borrowing or lending funds. Usually banks are major participants in this business, but a variety of other parties can also be active, ranging from international organizations to private persons. Depending on the structure of the economy, the importance of individual participants can differ a lot and the accessibility of information can be quite different. Access to data from banks and international organizations is usually regulated, and barring illegal activities, should be relatively straight forward. For other sources of data, and potential unlawful operations, it may be much harder to identify and extract accurate information on the subject. Surveys can shed light on some of the flows, but in other cases inference from other data, such as stock data, comparison of potential interest rates across different activities or regions, and examination of transactions across borders can be used for approximations. Comparison between different countries can also help, as in some instances better information may be acquired on the credit side of operations (International Monetary Fund, 2014, p. 39-40). Using reconciliation statements, where structured approach is used for accounting for and comparing data, is recommended in the *BPM6 Compilation Guide* (International Monetary Fund, 2014, p. 40). Illegal activity is much harder to account for, but sometimes information from the police, prosecution services, or even the media can give useful information that can be used for reference purposes, although great care must be taken when evaluating the effects on the economy.

Distributed income of companies and reinvested earnings can sometimes be inferred from company statements or tax records, but surveys can also be used to complement the information. Care must also be taken to create a counter accounting item consistent with the valuations of the items as stressed in the *BPM6 Compilation Guide* (International Monetary Fund, 2014, p. 41).

Rent in the Primary Income Account refers to income from natural resources and should not be mixed with rent of other items, such as buildings or machinery, which falls under Services. Accounting for rent can be complicated as data is often not accessible or trustworthy. Official accounts or tax records can sometimes be used for data about rent for natural resources, but in other instances these data can be had from companies' income statements. OECD has put work into evaluating natural resources and measurement systems, which can be useful when defining and possibly accounting for rent for these (Ven, 2012).

It should, in theory, be relatively straight forward to account for taxes on products and production of foreign entities operating within borders, but that obviously depends on how the registration is structured. It is therefore imperative to examine the structure and have it repaired if there are chances of incorrect reporting. Taxes paid on products and production abroad by domestic parties can be harder to account for. Surveys are probably the best way to assess these. Often official bodies can provide information about subsidies, but it can sometimes be a problem, where these are sometimes intertwined with other items and can be hard to distinguish. Subsidies that domestic companies receive abroad can also be problematic, as country-specific information may not be available everywhere.

3.4.1.3. Secondary Income

Secondary Income refers to items that involve currents transfers between residents and non-residents that do not affect national income items in the National Accounts. These items affect gross national disposable income along with Primary Income items, but are not capital transfers. These can be personal transfers, such as gifts, grants, lottery gains, taxes on income and wealth, social payments, nonlife insurance premiums and claims, international cooperation and other current transfers.

Primary sources for personal transfers are payment intermediaries and surveys, such as household surveys or specific surveys tailored to catching these items. These transfers can be difficult to distinguish from other information and the risk of double counting is real. Taxes should, in theory be relatively straight forward, especially those levied by the respective economy, but information about taxes paid abroad can be harder to get. Social payments data, especially from the central government is usually relatively easily acquired, but in some instances data from local governments can be harder to get. Exchanging data about taxes and social payments between countries could aid considerably in getting correct data. Insurance activity is often regulated and there are requirements for information, which should include data about foreign payers and receivers. Sharing information between countries would benefit both. Other transfers can sometimes be captured in payment intermediaries' data, but surveys and data gathering from foundations and organizations that provide scholarships can also be examined. As with all data collection the relative importance, cost and benefits must be analyzed prior to embarking on data collection exercises.

3.4.2. Capital Account

The Capital Account measures changes in non-produced and non-financial assets, such as natural resources, contracts, leases and licenses, marketing assets, debt forgiveness and other related transactions. As this category is very widely defined, problems with monitoring it can be numerous.

Land purchases may be monitored via land registers, but leases need not be officially registered everywhere. Some contracts, such as fishing rights or mining rights may be negotiated, but valuation can be difficult, especially if payment is based on future harvesting of the resources. These contracts may be registered in the country owning the resources, but information to the external authority may be limited. Sharing of data is an obvious way of helping to remedy the problem.

Marketing rights, trade marks, franchising agreements, and other intangible assets can be very difficult to value and sometimes to even become aware of. Sometimes these are part of the value of

a company that has been sold and need to be somehow distinguished from other assets and priced appropriately. Surveys can help in getting some information, but other methods might include enlisting the aid of national organizations, such as trade associations or chambers of commerce to create an awareness of the issue and possibly attempting to create registers that would contain these information.

Rights to the services of professional sportspeople are sometimes traded and it can be hard to get information about these contracts. Agents, lawyers or auditors are usually involved in these trades and given appropriate legal structure can be mandated to provide these kind of information. Sometimes reports[13] or news[14] are published on the valuation of individual sportspersons that can aid in evaluating some exceptional cases. These can give clues to potential valuation or sometimes provide sources for further research. Care must be taken when evaluating data of this sort, as methodology for creating the information and due diligence of research can be flawed.

Debt forgiveness, which should not be confused with debt write-offs, is an item that can be very hard to isolate and find information about. Potential sources for these information are companies' income statements and tax records, in case the debt forgiveness creates a potential for capital gains that are taxable.

3.4.3. Financial Account

Financial Account transactions involve financial instruments and are thus somewhat better defined than some other categories in Balance of Payments statistics. The Financial Account is classified into: Direct Investment; Portfolio Investment, Financial derivatives (other than reserves and employee stock options), Other Investments and Reserve Assets. Usually quite a large proportion of trade in these categories involve financial companies, which are regulated and thus should ease the information gathering process. However, some of these trades do not involve financial companies, which requires other sources of information. Tax data, company records and registration data are among the most useful sources of information about some of these activities. When complex corporation structures become a problem, it can be advisable to contact auditors and even authorities that examine tax evasion in order to gain insights into the real ownership of the structures. IMF staff can also be very helpful in explaining how to untangle and account correctly for different items in very complex cases.

3.5. INTERNATIONAL INVESTMENT POSITION SPECIFIC ITEMS

End of period positions can be surprisingly tricky to evaluate, timing of acquisitions or creation of liabilities is sometimes not clear, complete information about events has not reached the hands of those that report. Sometimes the complexity of deals is such that it can be very hard to distinguish certain items from others that may not be cross border, interconnection between items can be hidden, and occasionally the structure of acquisitions and disposal of assets and liabilities is deliberately designed to obfuscate the real effects of the event. Complex and ever changing corporate structures and networks of holding companies with interlinkages in different regions also create difficulties in accounting correctly for all changes that occur.

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[13] https://en.wikipedia.org/wiki/List_of_largest_sports_contracts
[14] http://www.forbes.com/sites/kurtbadenhausen/2015/06/10/the-worlds-highest-paid-athletes-2015-behind-the-numbers/#559ea7251e99

3.5.1. Assets

Official reports, such as land-, property- and corporation registries can be valuable sources of information about foreign ownership. Most countries have such registries and the compilers of International Investment Position should reach out over to other countries and search for data about foreign holdings of domestic parties. Surveys among companies are very important, either random sample surveys or tailored surveys that reach a large portion of the most active actors in cross border acquisitions. Monitoring the media and company news releases can be valuable, and in some countries there are companies that specialize in providing such monitoring services. Company auditors can often provide information about complex structures of the companies that they serve. Cooperation with other compilers of Balance of Payments and International Investment Position statistics in other countries is also preferable and serious thought ought to be given to lifting regulatory barriers that may impede such cooperation. Where two separate authorities are responsible for producing National Accounts and Balance of Payments Statistics these should cooperate and exchange information as in some instances one of these can get information that may not be available to the other. Using the CDIS and CPIS issued by the IMF can also be a starting point in investigating data gaps that can be obvious when these information are compared with domestic data, giving clues about which countries and which sectors should be looked into.

3.5.2. Liabilities

Tracking liabilities involves monitoring media reports about debt issues abroad, researching how acquisitions are financed and surveys among companies and sometimes private individuals. Bank data is important and authorities in different countries should seek to exchange information where possible. Tracking liabilities can be much more complex than tracking assets as there are relatively few registers that are involved and debt can change hands without much reporting. Innovations, such as ANACREDIT[15] the European Central Bank credit register is a very promising initiative that will undoubtedly enhance the consistency and accuracy of liability reporting in the countries that participate in the project. Initially the scope will be limited to loans to corporations and other legal entities, but hopefully that will be expanded to other entities, such as households within a relatively short time. ANACREDIT is expected to begin in 2018.

3.6. DETECTION OF ERRORS

For the compilers of statistics, detection of errors is a never ending task. A vast armory of methods, along with endless patience is needed and constant questioning is a necessary quality. Systematic approaches help minimizing the effects of known sources of errors, but sometimes new or unexpected errors crop up, which may elude the compiler. Errors can be harmful and may diminish trust in the compilers and the methodology that is used, but honesty and sincere will to improve the methods can help in reestablishing trust. Producers of official statistics are always aware of the potential effects statistics have on economic decision making, but they have to be very careful to be up front about possible deficiencies in their numbers and produce them in a neutral manner that does not take political sides.

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[15] https://www.ecb.europa.eu/stats/money/aggregates/anacredit/html/index.en.html

There are many methodologies that are applied in detecting errors. Some focus on the overall system, for example structure of the economy and the potential sources of data, some on the collection methods, some on statistical analysis, and some on the production methodology. Comparison with other data is vitally important as well as consistency checks, both within the frameworks and across different systems.

3.6.1. First Level Checks

First level checks revolve about the reports or data sources that are used in the production of statistics. Below are some of the questions that statisticians must frequently ask themselves.

- Are data reports or data sources sufficient for the production of the necessary statistics?
- Is the collection of data cost-efficient, given the benefits?
- Is the accuracy of data collection acceptable?
- Is the population correctly defined?
- Is a sample appropriate and representative?
- Is the reporting period correctly observed?
- Are reports properly filled out?
- Is everyone using the same units in the reports?
- Are there abnormal numbers in any fields?
- Is it possible to device consistency checks on the reports?
- Can the reported numbers be verified or cross-checked with other data?
- Is a quality system in place for the data collection?

3.6.2. Second Level Checks

Second level checks focus on the handling of data and the production of the statistics. These involve the storage and accessibility of data, the overall design of the production and dissemination and built-in procedures for checking the validity of the output. Some of the questions frequently asked should be:

- Is the data storage system secure and reliable?
- Is all necessary data accessible to the producer at the right time?
- Are methods for handling data efficient and reliable?
- Are methods for estimation grounded in acknowledged statistical methodology?
- Is the overall design of the production efficient and sufficient?
- Do production methods add to or enhance the probability of errors?
- Are the producers sufficiently proficient (educated, experienced) to complete the work?
- Are automated systems appropriate for the work?
- Are there alternative methods that can aid in the production?
- Is there a channel for feedback from users?
- Is a quality system in place for the production?

3.6.3. Comparison

One of the most important method for validating data is by using comparison. Comparison can be horizontal, i.e. consistency of the accumulated data against other data in the same production period

or vertical, where the data is compared to historical data of same kind. A variety of methods has been developed for this purpose, one of which is actually Net Errors and Omissions, which is actually a "check-sum difference" in horizontal consistency of Balance of Payments. Outlier detection, checks for auto-correlation, auto-regression, and seasonality, are examples of testing methods that can be applied in vertical consistency checks.

3.6.3.1. Horizontal Checks

Horizontal checks are used for evaluating the validity of the statistics within the framework of production. For example, Balance of Payments, is a framework that consists of three main components: Current Account, Capital Account and Financial Account. Net Errors and Omissions represents the difference when the sum of Current Account and Capital Account is unequal to the Financial Account. Net Errors and Omissions are in fact a horizontal check. Research into each component can give clues to the cause of the difference, and is thus very important. However, there are rarely absolute answers to be found when errors are large. If the Financial Account is substantially higher than the summed Current Account and Capital Account, the reasons can be many and sometimes a combination of many different reasons. The Financial Account can be overvalued due to leftovers from the previous period, spillovers from subsequent period (period shifting), double reporting of some activities, and in extreme cases it can actually be undervalued, but the Current- and Capital Accounts even worse undervalued. Current- and Capital Accounts can suffer from the period shifting, where spillovers from previous periods actually inflate the values and so on and so forth. Therefore, the overall framework must be very carefully constructed and audited to minimize the structural effects of errors on the whole system. The BPM6 and the relevant compilation guides provide a very well developed model, which is invaluable in constructing and validating a system for collecting and producing reliable Balance of Payments statistics. Checks within each components are also necessary as to ensure conformity.

As the system is based on double-entry accounting, each transaction has a counter transaction, which must be identified and the compiler needs to ensure that double counting as well as underreporting does not occur or develop methods where the effect of these problems can be minimized. The inherent linkages due to the structure of the system should be exploited to as great an extent as possible. For example changes in International Investment Position involve changes in the Financial Accounts, as can be seen in figure 2.1, and very often reverb through the Primary Income Account in the form of interests or retained earnings. Tracking these chains is important and can shed light on possible omissions that occur when the double-entry accounting principle is not totally fulfilled. Simple actions, such as deposits and commercial loans involve service fees and interest payments which must be fully accounted for.

Technically usage of "internet currencies", such as Bitcoin can involve transactions between countries, but as the holdings and transactions occur in a very opaque environment it is next to impossible to account for these. And even if it might be possible to catch cash-ins when these are exchanged for official currency there are still often very complex problems outstanding, such as valuation and the identification of the counterparty.

When accounting for trade in goods, the payments for these goods must be examined in detail. If the payments are with cash transaction, where is the best source of information about the payments? If the payment is via wire transfer, the source needs to be identified. If there is trade credit involved,

how is that accounted for and where is the necessary information? Merchanting "that is, the purchase of goods by a resident from a nonresident combined with the subsequent resale of the same goods to another nonresident without the goods being present in the compiling economy" (International Monetary Fund 2014, pp 21) involves further complications, such as identification of the principal actors and the relevant transactions, which always need to be examined in-depth so as to identify the correct categories for both the debits and credits. Fringe cases must be examined, for example returns of goods, barter type trades must be identified and so on. Regime shifts, such as substantial increases in internet trades must be examined to evaluate the need for further data collection and the proper accounting. Big ticket items, such as trades of airplanes and ships often involve very complex financial transactions, often involving intermediaries and financial companies that are located out of domestic official reach, can tax the resilience of the Balance of Payments compilers by complicating the proper accounting for all the different avenues, thus creating the potential for omissions and errors.

Services trade can involve considerable time lags that need to be properly accounted for. This can involve trade credits or in some cases financial structures that need to be identified. These can involve interest payments or deductions, service fees and costs that also need to be identified and accounted for. Net settlements between service providers in different countries can complicate correct handling, such as in telecoms services and international debit and credit card services. Costs and fees need to be identified and accounted for as well as possible interest payments.

Primary Income account often involves computed or evaluated flows rather than real transactions, which can be complicated to arrive at, but does not change the underlying need for balancing the debits and credits in the double-entry accounting system. Primary Income Account involves items such as: compensation of employees; direct investment Income on equity and investment fund shares; dividends and withdrawals from income of quasi-corporations; reinvested earnings; interest, income or dividends on funds and equity; rent; and taxes on production and imports. Compensation of employees can be regarded as a specialized subject due to the complexities of payment methods and accompanying items, such as taxes, fees and social contributions, wages in kind such as meals; accommodation; sports, recreation, or holiday facilities for employees and their families; transportation to and from work; goods and services from the employer's own processes of production; bonus shares distributed to employees; and so forth (International Monetary Fund, 2009, p. 186), that can prove to be very hard to trace and require attention to details in order of accounting correctly for all the different items and the counter accounts. Retained earnings is an example of an item that often needs to be evaluated by either using information from the individual sources and/or comparison with similar activities in the economy or even in other countries. Accounting for all the threads, especially within complicated structures where ownership can be partial and split between different countries and companies calls for systematic and disciplined approach.

Secondary Income account presents the added complications of sometimes having items or concepts of no economic value being exchanged in return for redistributed income. Secondary Income Account includes items such as personal transfers; current taxes on income wealth, etc.; social contributions; social benefits; net premiums on nonlife insurance and standardized guarantees; nonlife insurance claims and calls under standardized guarantees; current international cooperation; and miscellaneous current transfers. These items, when paid out of the country are usually traceable

via official sources, such as social offices or tax authorities, insurance companies, pension funds and banks, but the identification of payments arriving from abroad can prove problematic, but financial institutions are often intermediaries who can aid in identifying the different types of payments received. A special case is the reconciliation of pension payments that need an adjustment item to correct for the effects on the Financial Account as described in BPM6 pp. 213)

The Capital Account covers acquisitions and disposals of nonproduced, nonfinancial assets, such as: natural resources; contracts, leases, and licenses; marketing assets; debt forgiveness and other assets of this kind. The Capital Account bears resemblance to the Secondary Income account as there may be no tangible economic value involved on one hand, against value or perceived value, such as land of embassies or leases or licenses. This obviously presents problems of valuations, but at the same time it is vitally important to observe strict adherence to the principles of double-entry accounting.

3.6.3.2. Vertical Checks

Comparing historic data is a true and tried method for gaining additional insight into data and often this can lead to detection of errors in the data. Depending on the underlying data this can be relatively straight forward or fiendishly difficult. In many cases there are small variations in the data, which if correctly observed eases the detection of errors and potential outliers (which can be legitimate or not). In other cases randomness can be high, sometimes limiting the use of statistical methods in evaluating the data. Data series that are summed from many different sources and data series that are netted often produce oscillations in the data that render it badly suitable to statistical checking. Data series that have gaps and few observations can also create problems of oscillations in data. Big ticket items, such as airplanes and ships often need to be excluded from error checking in order to avoid the disruptive effects on the data. Methods, such as trend analysis, variation of changes, outlier detection, seasonality checks, auto-regression and auto-correlation can be used to shed light on anomalies and sometimes systematic weaknesses in the data. Familiarity with data, procedures, processes, and insight by experienced compilers can also be very important when examining data. However, sometimes expertise can become a hindrance especially when the expert places too much trust in the methods that have been used forever, discounting other methods or new developments. So it is very important to approach all examination of data with open mind and consider likely as well as unlikely cases when working on data.

3.6.4. Reconciliation with Other Sources

One of the most important validity checks is to reconcile data with other sources. Reliance on one data source invites undetected errors, which can disrupt data and analysis. Official records are generally thought to be reliable, but caution should always be used and the methods for the collection should be examined. If there are alternative methods, that can verify or discredit official data, these should be examined as well. Sampling alternative data can be used in some instances, allowing for extrapolation for comparison and reconciliation, although strict adherence to robust statistical methods should be applied at all times. If inconsistencies are observed, these should be examined to find explanations, which might lead to changes in methodology and better data.

3.6.5. Asymmetries

When observing statistics about flows and positions between two or more countries it is often noted that there exist significant differences in the data. One country might report exports to another country, which in turn reports significantly different imports from the first country. This casts doubt on all statistics and calls for explanations. Initiatives have been created to share data between countries to try to limit these discrepancies, such as between United States of America and Canada, and the FDI network between various countries in Europe (Kilbarda, 2013, pp. 25; Berman, Dozier, & Caron, 2013; European Commission, 2016, pp. 27). This area is very promising as a method for enhancing quality of Balance of Payments statistics, but it calls for added resources and sometimes there are political reasons that prevent or limit the exchange of data. Confidentiality is very important to those who report data and sometimes competition between large companies in different countries can lead to unwillingness to share data. Multinational corporations that operate in many different economies, sometimes with very different activities, are very problematic to Balance of Payment compilers. Sharing data by the various countries would undoubtedly enhance the information on these activities and create a more stable platform for handling data about these parties.

3.6.6. Revision Histories

One of the tools available to compilers is researching revisions to published data. This can be used to identify the areas that need to be monitored with respect to likelihood of being sources of errors. Revisions can also shed light on timing problems, such as period shifting. By researching revisions the quality of the eventual statistics can also be evaluated, thus, when it can be expected that the numbers are final and should, on average, not change (Damia, & Aguilar, 2006; Ghosh, 1997). This is important to analysts and decision makers, as provisional data may be unreliable and could potentially distort decision making. One caution must though be put forward. Revision policies can distort and render revision histories untenable. Revision policies suppress some revisions until a certain period of time is reached, when many or all of the unpublished revisions are applied. This methodology can lead to major changes in published statistics, often without mentioning when the discrepancies were found. This greatly diminishes the use of revision history to get a grip on timing problems and has the potential of obscuring information from policy makers. However, if the producer of statistics tracks the real revisions these can obviously be used without being biased, but as these are usually not published, transparency suffers.

3.6.7. Consistency Checks

As Balance of Payments statistics are now mostly aligned with National Accounts, there is an opportunity to compare data across these two systems for consistency. For example, the Current Account balance links to the National Accounts as it is equal to the saving-investment balance for the economy (International Monetary Fund, 2009, pp. 207). The Capital Account has a direct relationship with the National Accounts. The relationship between saving and net lending/net borrowing is shown in the capital account of the SNA as:

   Net lending (+)/net borrowing (−)
   =Saving;
   − Acquisition of nonproduced, nonfinancial assets;
   + Disposal of nonproduced, nonfinancial assets;

+ Capital transfers receivable;

– Capital transfers payable. (International Monetary Fund, 2009, pp. 216).

Various aspects can be addressed, such as finance flows, flows of goods and services, production, and investment. Historical comparison of relationships such as the development of Gross Domestic Production to imports, exports, and investment can also be examined, both for new insights into the relationships, but not the least to search for clues about inconsistencies in data.

3.6.8. Identifying Weaknesses in Processes

The Balance of Payments Manuals, which have evolved since the first manual was issued in 1948 have iterated on good practices in producing Balance of Payment statistics. The current manual (BPM6) along with the compilation guide provide a very thorough description on how to identify data sources, how to structure the data collections, how to test data, how to store and process the data and methods for estimating and imputing information, where data quality or lack of data makes that a necessity. All this provides a valuable tool for creating a setup that efficiently produces accurate information. However, alternative ways or methods can be used and sometimes specific circumstances can create an opportunity of using other means than those described in the manuals to gain access to better data or information. It is therefore imperative that the compiler examines all the processes that are used in the production of the statistics, not only with the view of identifying the most appropriate ones, but also with the view of how the existing ones can be amended or refined so as to get better results. A systematic review of all processes is therefore a very valuable exercise. Questions such as the ones below can aid when reviewing processes:

- Why are current sources of data used rather than other alternatives?
- Is there a gain in using a smaller/larger sample?
- Can collection methods be optimized?
- Can accuracy be improved by adding data from other collections?
- Are testing methods likely to discover serious errors in data?
- Are estimation methods correctly modelled/applied?
- Have calculation methods been verified, also in marginal cases?
- Is counter accounting likely to match?
- Are data links stable?
- Have there been recent changes in the economy that may disrupt collection of data?
- Are monitoring systems, e.g. for new activities, efficient?
- Is the production of the statistics consistent with the manuals?
- Could it be beneficial to have outside experts scrutinize the systems used?

3.7. REMEDIES

It is probably not possible to totally eliminate errors in official statistics, even though in some cases the causes for the errors may be known. Usually too high a cost or unrealistic effort is the main obstacle for perfectly correct statistics. Given these restraints and realistic expectations, often there are remedies to both methodology and treatment of information that can improve the results. Adherence to systematic methodology and thorough understanding of the subject are basic components that need to be in place. Statistical methodology has developed rapidly through the last centuries and underpins scientific approach to the subject, but care must be taken to follow the rules

and be aware of the numerous limitations that apply. Common sense and systematic approach can also go a long way in working out reasonable compromises when other restraints become too demanding. Quite a lot of knowledge has been accumulated through the years among the producers of official statistics, which is manifested in the manuals that have been compiled in the specific field of Balance of Payments and International Investment Position. Specific subjects within this field have also been debated and researched throughout the years and often point to solutions of certain problems. As mentioned cost and effort may be obstacles, but importance of the information should always be measured against the effort, and if the results are not sufficiently accurate, some remedial action must be taken to improve the results. Increased cooperation between different countries and amongst national statistical bodies is probably the most efficient way to minimize data gaps that often are glaringly obvious.

3.7.1. Validating Systems and Methodology

The most basic requirement for the producers of Balance of Payments statistics is that their methods conform to the standards that are set out in the manuals issued by IMF. Most if not all producers have built their own specific systems for this purpose. These systems are created according to the requirements as understood by the producers and often account for peculiarities that apply to the economic realities of the individual countries. No homogenous solution exists and various technical platforms are used. Furthermore, data sources can vary quite a lot between countries and quality can be very different, both amongst sources and between countries. IMF has for years offered courses and seminars for producers of Balance of Payments, where attendees receive thorough education on general or specific areas within the field. IMF has also offered technical assistance programs for members where their systems are thoroughly researched and suggestions made for improvements. Initiatives such as "Reports on the Observance of Standards and Codes"[16] (ROSC), data quality frameworks and peer reviews can also be valuable tools for systematically researching the underlying systems and frameworks for the production of official statistics. User groups can often provide valuable input into discussions about the framework and methodology. Co-operation between official bodies that produce statistics can also aid in spotting errors in systems and methodology. As Balance of Payments statistics and International Investment Position are basically accounting systems it might be advisable to employ certified auditors to validate the systems as they are usually trained in that field and might throw up different views on problems and potential solutions based on their experience.

3.7.2. Consistent Definitions and Disciplined Adherence

The BPM6 and the Compilation Guides give the compilers the option to decide on a lot of issues that affect the production of the statistics. Among the variety are concepts, such as timing of transaction, location of handover, ownership handover, and pricing or valuation issues. It is important to examine these issues well before deciding which method or definitions are applied. Consistency is important, such that one transaction is not treated different from another similar transaction and that counter accounting does not introduce sources of errors into the framework. In general when the principle decisions have been made these should be enforced consistently and in a disciplined manner, however there may arise situations that crave different approaches. For example during a period of turbulence in international trade it might be advisable to treat very large transactions, by using spot

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[16] http://www.imf.org/external/NP/rosc/rosc.aspx?sortBy=CountryName&sortVal=P

exchange rates instead of using average rates or end of period rates as otherwise errors would be compounded.

3.7.3. Source Testing

Reliable sources of data are imperative for accuracy of statistics. Depending on circumstances, there may be different origins for data that need to be evaluated based on reliability, accuracy, approachability and sometimes cost and effort. The availability of two sources is invaluable for comparison that can lead to further knowledge of the data, aid in spotting errors, and studies of the sources of the errors. Even though other official sources of data can be available, care should be taken to study what the premises of the data are, what methodology is used when producing the data, how it is applied, and potential problems in the coverage, collection, production and dissemination. Political affiliation should not affect official statistics, but that may not be the reality everywhere, this must be taken into account. Other data sources than official must also be evaluated and tested where possible. The form of gathering data is also important, using censuses is well known, but carries potential problems, such as cost, time needed to gather data, difficulties in obtaining the sampling frame, difficulty of obtaining responses from the whole population and potential sampling errors. Sampling surveys have certain well known benefits, such as scientific support when properly administered, which can also work against the statistician, when sampling frames are inadequate, replies are insufficient or response rate is not good enough to draw reliable conclusions.

3.7.3.1. Coverage

Here, coverage refers to the amount of data observed in a study compared to the total. Sometimes it is close to impossible to evaluate both the coverage and the total, but in other instances both are well defined. An island in the middle of the ocean has better opportunities of observing people or goods entering or departing its shores than a country with multiple access points with many neighboring countries. However, that does not entail that it is possible to observe all movements to and from the island as there may be smuggling of both people and goods that takes place somewhere outside officially recognized entry/exit points. The economic importance of coverage errors need not be great, but it is important that it is recognized and some effort is made to estimate how great the coverage is, what form it takes, and how it can be improved on. For example, if smuggling is not frequent, but the items smuggled are of great value, the economic effects might be larger than anticipated. It could therefore be advisable to perform a cost benefit study to evaluate whether some measures should be taken to improve coverage.

3.7.3.2. Collection

Testing collection methods is very important in order to discover weaknesses in methodology. Ensuring that the methods measure all that they should and no more and no less should be done either regularly or whenever an opportunity presents itself. Even if primary collection is done by other bodies, it is important that the statistician is familiar with the procedures used and potential weaknesses. For example when importing goods, the actual handover may take place at a different time from official recording. Often this is not important, but sometimes when big-ticket items, such as airplanes or large ships this may matter a lot and create errors, such as if the timing of the recording falls in the wrong period, then it will create errors in two periods. Accounting for imports

and exports of services is very complicated and the statistician must be constantly on the look-out for new services forms as well as different methods for registering or non-registration of these. Regular audit of the methods used is probably one of the most valuable way of ensuring that the collection methodology is up to its task. Sampling frames must be constantly monitored and the statistician should be aware that there might be overlooked sources of input, sometimes official, sometimes business sources and sometimes news stories can shed light on previously unregistered activity, which should be monitored and added to the sampling frame. The mediation of data needs to be examined as well as the data itself. For example, it should be monitored whether all the data that was sent from the original source was received, this can be done by using counting and comparing and check-sums can also come handy. Even if communication is via electronic pathways and automatic, it is necessary to ensure that all the data is received, no duplications occur and no corrupted records arrive. Manual procedures for entering data into automatic systems need to be tested and care taken to ensure that errors and methods that are prone to create errors are kept at a minimum. Double data entry, and/or entry by separate persons can aid in minimizing data entry errors. Comparing the data from regular data sources against previous entries is also an important error detection method. Regular contact with people of the data source can minimize surprises and explain changes that can answer questions later in the production chain. The earlier in the process the errors or anomalies are detected and remedied, the lesser will the bad effects be.

3.7.3.3. Production

When the data arrives it is important to store the incoming data securely and ensure that access to those that need is unconstrained. Source data should be kept separate (and preferably unchangeable) from data that is used in the production to ensure that errors in data handling do not corrupt the source data. Before publication comparison of source data in some manner should be performed to test for possible corruptions in the production. Anomalies that arise in the production phase may prompt changes in collection methods and need to be properly disseminated to those that handle the source data.

3.7.3.4. Dissemination

Comparing the data that appears in public against the data that was supposed to be published should be mandatory. Sometimes errors in dissemination processes can creep in and cause havoc in publication. Selected comparison with source data could minimize these dangers.

3.7.4. Comparing and Exchanging Data

One way or the other all producers of statistics use comparison as the basic method for discovering errors. Comparing data against previous data is more or less standard, but techniques sometimes differ. Time constraints are probably the most important limiting factor in thorough examination of data. It is imperative to develop effective methods that give the most effective results. Human observation has its limits. Familiarity with data, training, experience, methodological approach are of great benefit, but against large quantities of data and lack of time these qualities often suffer. Using computational aids is therefore essential in the modern world. However, human observation should not be discontinued as automatic error checking has its limits, such as faults in design or implementation and is rarely designed to respond to shifts in paradigms or major events.

Top down or bottoms up approaches can both be used for error detection but often it makes sense to prioritize the efforts based on importance or values. Usually statisticians are not bothered with small errors in small or infrequent measurements, however these should not be dismissed if an opportunity presents itself for improving methodology in an efficient or cost effective manner.

Using basic statistical checking, such as comparison of changes from the last observation against standard deviation of previous changes can be used to highlight anomalies and establish simple rules for flagging items for further research. This works particularly well when data is rather regular and well formed. When there are gaps or lags in data this method is more prone to raise false positives in the testing process.

Comparing known or expected relationships in data, such as behavior of related data series, adherence to general or specific economic development or cyclicality, or reported news-stories showing up in the data is another way of using other information to flag changes in data and prompt questions about it.

Exchanging data or information with other bodies, official or unofficial, is a common way of enhancing data. This usually benefits all as this sheds light on different practices, and can lead to improvements in methodology and aid in correcting public misconceptions. Different approached to data collection should be researched, such as when trade organizations use surveys to highlight development in their industries, as it sometimes can lead to better sources.

3.7.5. Testing Processes

All systems for data collections, production and dissemination of statistics rely heavily on processes. These processes are often set up in accordance with the manuals or practices that have been developed internally over some time. These can be simple or complicated, but it is essential to document all processes very thoroughly to ensure that methods are systematic, commonly understood and followed. One way to test the documentation is to hand it to new recruits and ask them to complete the process. Obviously close monitoring of recruits needs to be carried out to ensure that every step is completed, but feedback from the same is very important as, both the processes and the documentation can be improved. Another method for checking the processes is to set up a test, where input data is put into the process and monitored as it is processed and eventually compared against expected output. Complicated processes and processes that provide cross input need to be examined as well. Handling of marginal and extreme cases must be specially tested, as these are very often sources of serious errors. For example, a few years ago negative interest rates on deposits would raise all sorts of warning flags, whereas today this is a reality in some economies. Testing for negative interest rates might be very relevant in some cases today and should be flagged, but in other cases testing for positive rates might be more appropriate as an error signal.

3.7.6. Correcting Methods / Processes

Systematic registration of errors and creating a history of corrections is good practice and can create a valuable guide that can aid in the adjustment of error detection methods and correction process. Careful study of the sources of errors is often needed to be able to properly correct these. A simple solution can sometimes work wonders, but great care should be used so as not to overlook other

aspects or new errors that might creep in when applied. Special care should be used when introducing new system or changing existing systems. All components should be tested and compared to previous data. If there are differences, these need to be examined and the source of the difference explained. Often errors in previous systems are found and sometimes these need to be corrected and published as well as any new errors that are discovered. Management of changes needs to be controlled and experts in the field of Balance of Payments should be present and consulted in all aspects that relate to the design and production of changes of systems and new systems.

3.7.7. Imputation of Missing Data

Missing data is a problem that most statisticians have to deal with. In Balance of Payments statistics it is more common than not that the data for the current production period is missing than that of data of older periods, due to lags in reporting. Often there is a valid reason for lack of data, but it needs to be addressed anyway. Sometimes if the data effect is insignificant missing data can simply be ignored. Other times older data can be carried forwards until new data replaces it, without having negative effects on the big picture. If data is preliminary, which it often is, a general warning should suffice to alert users to the fact that the data may be imperfect. Sometimes, however, it is necessary to impute the missing data, due to the effects it could have on the final results. Several methods are commonly used, such as extrapolation based on previous values, trends or imperfect support data. Sometimes reported data is believed to be unreliable or lacking in quality. Therefore, there may be need for re-estimation of the data before publishing. Great care needs to be applied when this is done as this can have consequences on the final results. Good practices are to warn the users if possible (sometimes that is not possible due to confidentiality issues).

3.7.8. Constructing Systematic Workflows

One of the best way to maximize the likelihood that statistics are produced according to standards is using disciplined and systematic workflows. Using well tested methods and components where each one works according to expectations and connects seamlessly to other modules improves the overall quality of the work. In many cases each nation has developed specific system for producing Balance of Payments statistics. These systems are tailored to their needs and idiosyncrasies and may very well serve their user's needs. Given that there are over 70 SDDS and SDDS plus countries it might worth the thought if it was possible to construct a common system that could be adopted by all or majority of these countries, thus ensuring coherence between different countries and eliminating different practices. Using open source programs could aid in validating the system by having different users examining the source code and suggesting changes that could enhance conformity. Starting a new system would also eliminate legacy problems that plague many old systems that have been amended and patched for years.

3.7.9. Synchronization amongst Different Compilers

Those that study Balance of Payments statistics for the first time often wonder why information published by two different countries do not match. In some cases there are large differences that only add to the confusion. This is well known and stems from different access to data, different methods and sometimes different importance of the counter party. In theory most of this difference could be eliminated by sharing data and information between countries. In practice this is much

harder. There may be regulatory barriers, based on e.g. national interests, business interests, competition views or even feuds between different countries. Other barriers are due to lack of resources, such as manpower or finances. It could be hard to justify spending resources by a large economy on reconciling trade, services or financial flows with a miniscule economy. Initiatives in Europe have been tried to a limited extent with the FDI network (European Commission, 2016 pp. 27) and the United States of America reconcile trade figures with Canada (Kilbarda, 2013, pp. 25; Berman, Dozier, & Caron, 2013). IMF collects data from its members using Coordinated Direct Investment Survey (CDIS) and Coordinated Portfolio Investment Survey (CPIS), which do not reconcile the data, but they produce "mirror-data", which is a table showing side by side, the data from one country with data on that country from all the other countries in the same category. This can show gaps and potential errors, but highlights the need for more reconciliation among different countries.

The potential benefits of sharing data between countries and reconcile the differences that are observed probably justify the cost and resources, especially if applied to the largest items, where small differences can add up to substantial sums.

4. RESEARCH OF NET ERRORS AND OMISSIONS

The research of Net Errors and Omissions was split into four categories, i.e. the study of Net Errors and Omissions as an item and its statistical characteristics (section 4.2), and relationship of Net Errors and Omissions with other variables. How crises can be predicted is an important issue, given the negative effects these have. Finding indicators that can reliably predict crises would give the potential for interventions with the aim of minimizing the cost for society. Can Net Errors and Omissions serve as such an indicator? (section 4.3), the study of revisions of Balance of Payments and International Investment Position items and its effects on Net Errors and Omissions (section 4.4), and a survey amongst the experts that compile the statistics (section 4.5). The aim of the study was to find more about out the characteristics of Net Errors and Omissions in different countries, such as randomness or seasonality, correlation to connected and unconnected variables, if there was anything to learn from revisions to data and find out the views of the experts that compile the Balance of Payments accounts for the various countries.

4.1. DATA

The International Monetary Fund (IMF) has for years published monthly financial data from its member countries. This data is now published on the IMF website[17], where new data overwrites older data if there is an update. The fund has also provided monthly CD's to subscribers, who can use a supplied browser for examining or importing the data or access the data directly via data files. For this research the CD's proved to be an opportune way of obtaining the revisions histories. The Central Bank of Iceland had a collection of these CD's, but with some gaps. With the aid of IMF and the Central Bank of Norway the bank had an almost complete monthly coverage from May 2003 to December 2015. The only missing CD was that of March 2009. However, as each data item on the CD is marked if there is an update or change to it, it was possible to reconstruct data for that month using data from the CD's preceding and succeeding the missing month, which should minimize or negate the effects of the missing data. Occasionally there have been published corrections to the CD's and these have been applied to the data where possible. During the research some anomalies and errors have been observed in the data. Depending on the severity or importance of these errors appropriate methods have been applied, either by dropping the offending data or imputing new data, using statistical methods, such as averaging or interpolation. The main database was constructed by selecting all series that contained Balance of Payments and International Investment Position from 2003 and few auxiliary items relating to exchange rates and major economic indicators. Data was collected for the countries that subscribe to SDDS and SDDS+ schemes of the IMF, apart from the following countries: Egypt – which only had data from 2011, Tunisia – which had no data at all, and West Bank and Gaza – which only had data from 2013. In some cases no quarterly data (only annual) was available on the International Investment Position. In total there were 69 countries in the database. The initial database contained about 16.5 million lines, however by eliminating empty data cells and unnecessary repetitions the database was reduced to just over 1 million lines. Other sources of data are referenced when these are used.

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[17] http://data.imf.org/?sk=7CB6619C-CF87-48DC-9443-2973E161ABEB

4.1.1. Problems with Data

In 2009 a new standard for producing Balance of Payments and International Investment Position was published by the IMF. The new standard was applied by different countries at different times during the subsequent years. IMF converted the statistics provided by individual countries to the new standard (BPM6) in August 2012, creating backdated data according to the new standard as far back as possible, in some instances as far back as 1976 in extreme cases. This creates inconsistencies in the data as some of the data produced by the old standard is revised after 2012 and some countries did not change their presentation until 2014 or later, thus there is an overlap in some instances, where data presented by the new standard is based on the old standard, but only on the latest and presumably fully revised data. Also some of the data attributed to the old standard may be revised according to the new standard. A further complication, which was not corrected for is the fact that the last publications of data have not been revised as often as previously published data due to the closeness in time to the research. This may distort some of the results, especially those that are produced according to the new standard, but as there are relatively few data points available, the author decided to use the available data as well as possible.

Netting and aggregations very often create oscillations in the data that distort the signal that is sought from the data. These items are therefore dismissed from the analysis where possible.

Revision policies can distort the usage of public data in this respect as timing of the observation of the change may be shifted which can limit the value of the exercise. In many instances, last quarter is revised, but other changes are "curtailed" until once a year when annual revision cycle completes. This creates a distortion, where changes might be "curtailed" for 2 or 3 quarters until they are revised, thus when the annual revision takes place there are accumulated 1, 2, 3 and 4 quarters worth of changes applied in one stroke. This clearly diminishes the impact of using revisions as indicators for finding deficiencies in methodology. This is separate negative aspect of revision policies, quite different from the effect that revision policy can have on economic analysis and decisions that is based on intentionally flawed statistics. Also, as data retrieval is nowadays digital and instantaneous the need for revision policies is not as important as it may have been when data was published in paper format, it now only creates artificial distortions to accuracy of data.

4.2. UNIVARIATE CHARACTERISTICS OF NET ERRORS AND OMISSIONS IN DIFFERENT COUNTRIES

As Net Errors and Omissions are a balancing item that represent discrepancies in the Balance of Payments accounting system its statistical characteristics are a worthy subject of detailed research. As the name implies two main components are involved: Errors and Omissions. Omissions can be caused by errors but by the nature of the two these components cannot be easily separated, at least not by using only the data series. One way to analyze the series is to examine how random the data is and look for evidences of systematic behavior, such as seasonality and trends.

4.2.1. Randomness

From a statistical point of view, errors are random occurrences that cannot be explained by the models that are applied to the data. These leftovers should by nature not be structured in any way, nor have systematic behavior. As there is no one universally accepted method for testing data series

for randomness, five tests were applied to the data using the R software[18], namely the Bartels Ratio test, the Cox Stuart test, the Difference sign test, the Mann-Kendall Rank test, and the Runs test. In all tests, the null hypothesis is that the data constitute a random sample so that each observation is randomly and independently drawn from its population. Otherwise stated, the alternative hypothesis is that the process that generates the set of data is not random. The five different methods are detailed and explained in Mateus, & Caeiro, (2014), as well as references to other material. Using the IFS data on all the countries in the database, which is described in section 4.1 an attempt has been made to evaluate the randomness of Net Errors and Omissions in the country specific data. Summary of the results is shown in Appendix II. Quarterly data from the first quarter of the year 2000 to the second quarter of 2015 was used, however, in some cases there was missing data either in the beginning or at the end. Only the latest data was used, thus if data was available in both BPM5 and BPM6 format, the BPM6 formatted data took precedence.

4.2.1.1. Bartels Ratio Test

Bartels Ratio test is rank version of von Neumann's Ratio Test for Randomness (see Bartels, 1982). The two-sided test was used. In 18 out of the 69 countries tested (26%), the hypothesis of the Net Errors and Omissions being random was rejected using 90% confidence level. Figure 4.1 shows the p-values of Bartels Ratio test for individual countries, the 10% significance level and 2% significance level used in the Bonferroni Correction, which is described later.
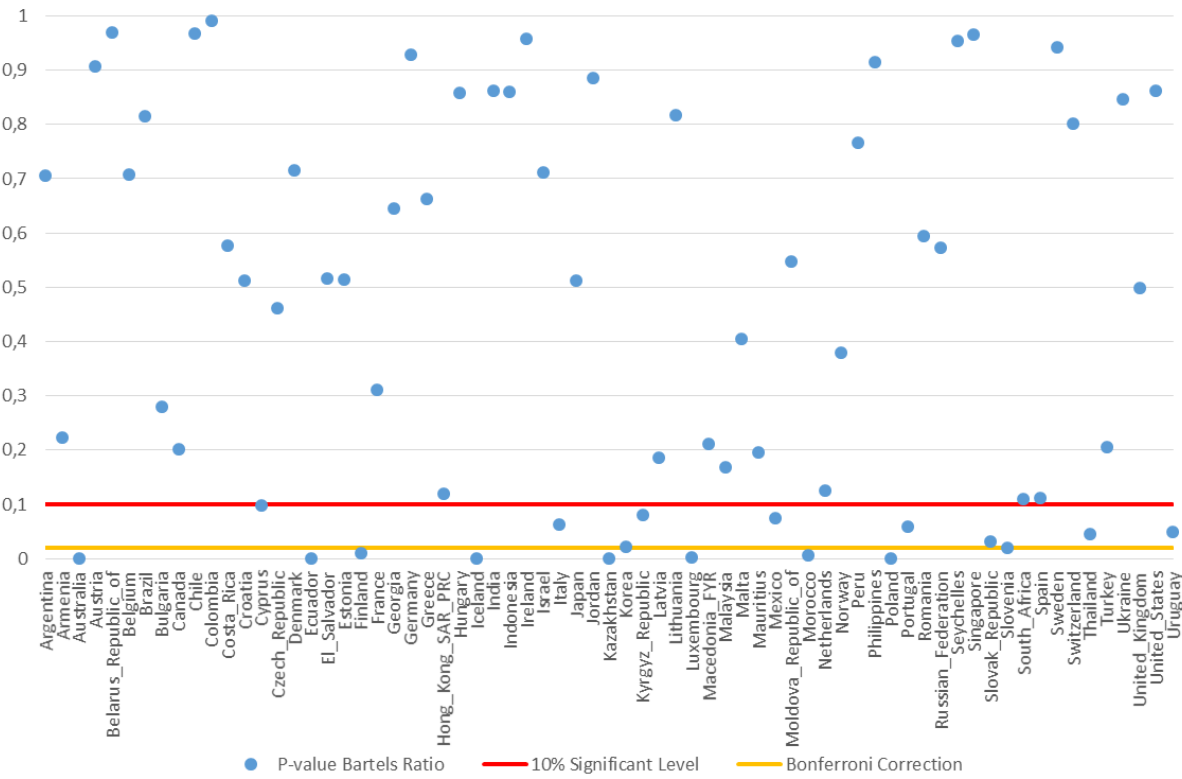
Figure 4.1 - P-Values of Bartels Ratio Tests

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[18] https://www.r-project.org/

4.2.1.2. Cox Stuart Test

The Cox Stuart test is a modification of the sign test using paired data of two halves of the time ordered series (see Cox & Stuart, 1955). In 8 out of the 57 countries tested (14%), the hypothesis of the Net Errors and Omissions being random was rejected using 90% confidence level. In 12 countries data was not useable in this test. Figure 4.2 shows the p-values of the Cox Stuart test for the individual countries with 2% and 10% significance level.
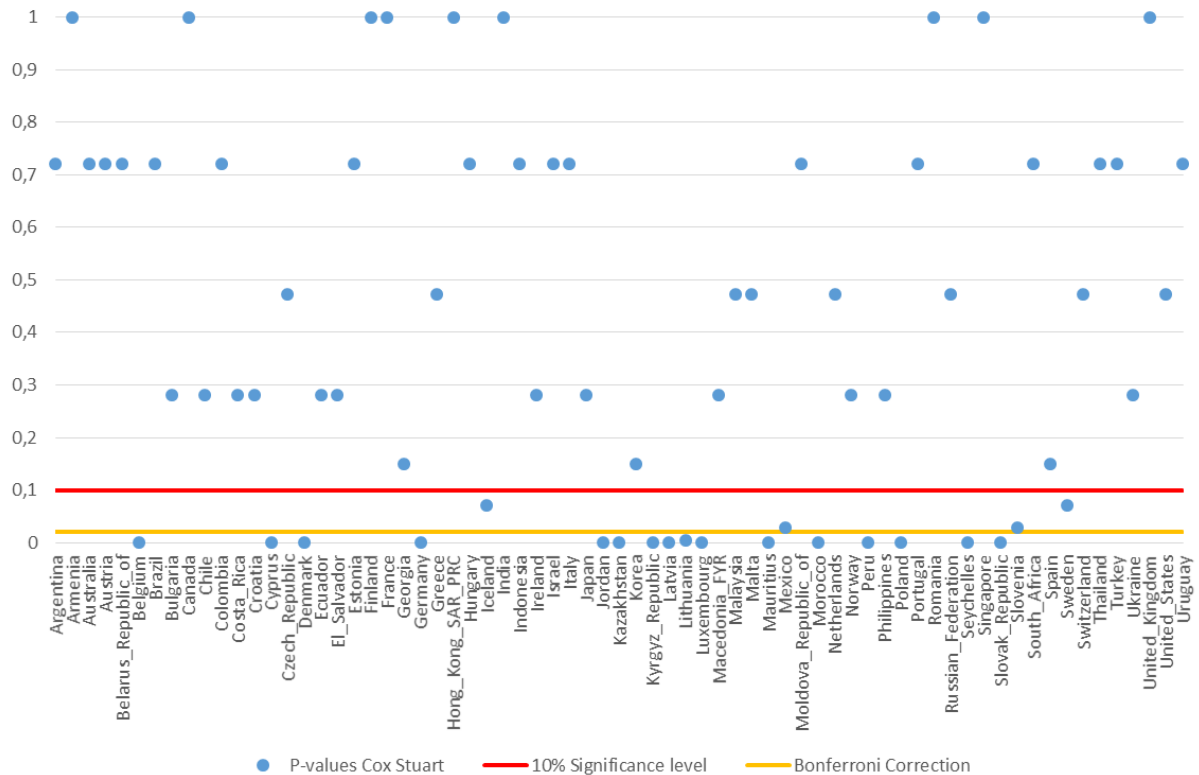
Figure 4.2 - P-Values of Cox Stuart Tests

4.2.1.3. Difference Sign Test

The Difference Sign test is nonparametric difference-sign test of randomness (see Moore & Wallis 1943). In 8 out of the 69 countries tested (11.5%), the hypothesis of the Net Errors and Omissions being random was rejected using 90% confidence level. Figure 4.3 shows the p-values of the Difference sign test for individual countries with 2% and 10% significance level.
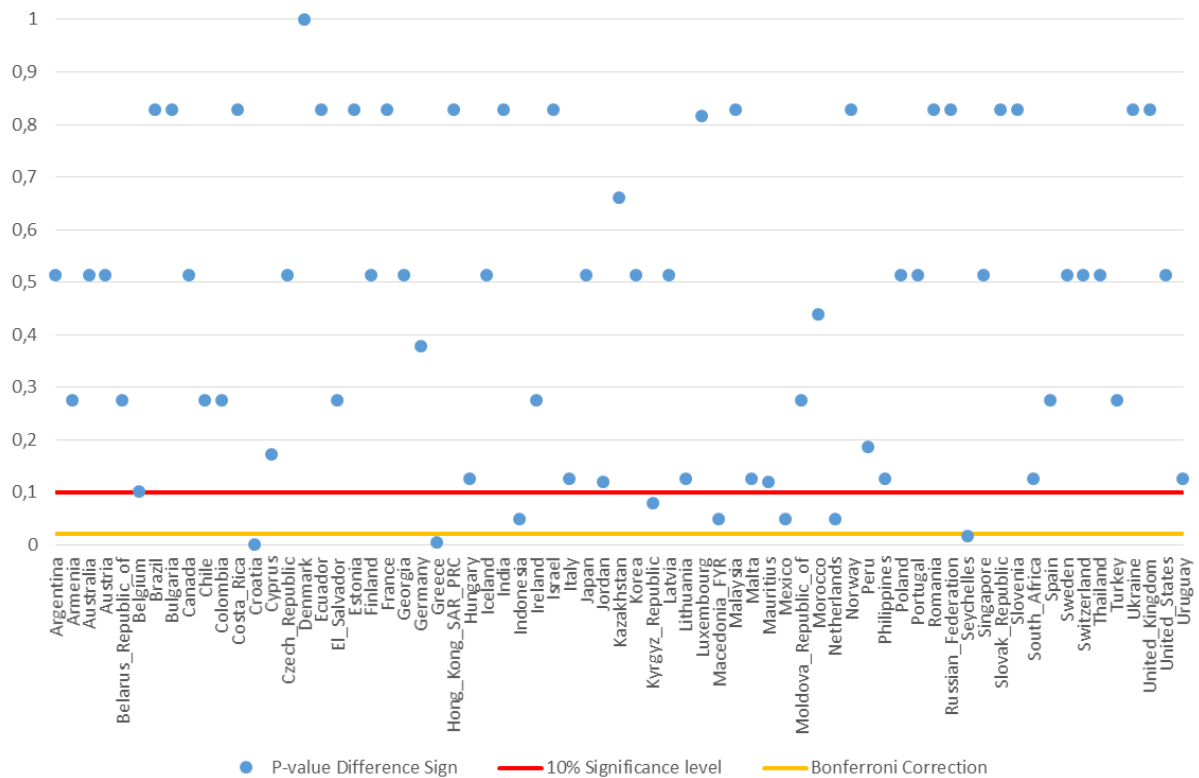
Figure 4.3 - P-Values of Difference Sign Tests

4.2.1.4. Mann-Kendall Rank Test

Mann-Kendall Rank test is different from the other tests as it tests if a monotonic trend is present in the data (see Mann, 1945; Kendall, 1975). In 12 out of the 69 countries tested (17.4%), the hypothesis of the Net Errors and Omissions being random was rejected using 90% confidence level. Figure 4.4 shows the p-values of the Mann-Kendall Rank test for individual countries with 2% and 10% significance level.
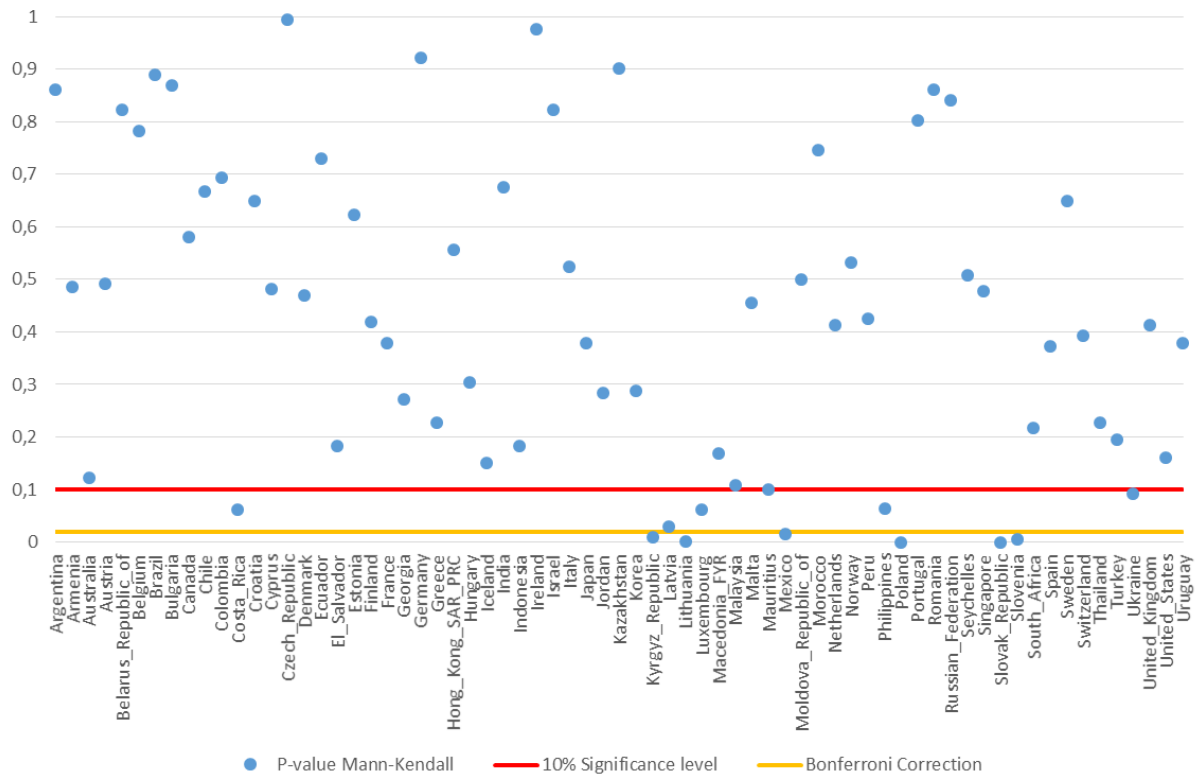
Figure 4.4 - P-Values of Mann-Kendall Rank Test

4.2.1.5. Runs Test

The Runs test, also named Wald Wolfowitz Runs test is nonparametric (see Wald & Wolfowitz 1943). In 16 out of the 69 countries tested (23.2%), the hypothesis of the Net Errors and Omissions being random was rejected using 90% confidence level. Figure 4.5 shows the p-values of the Runs test for individual countries with 2% and 10% significance level.
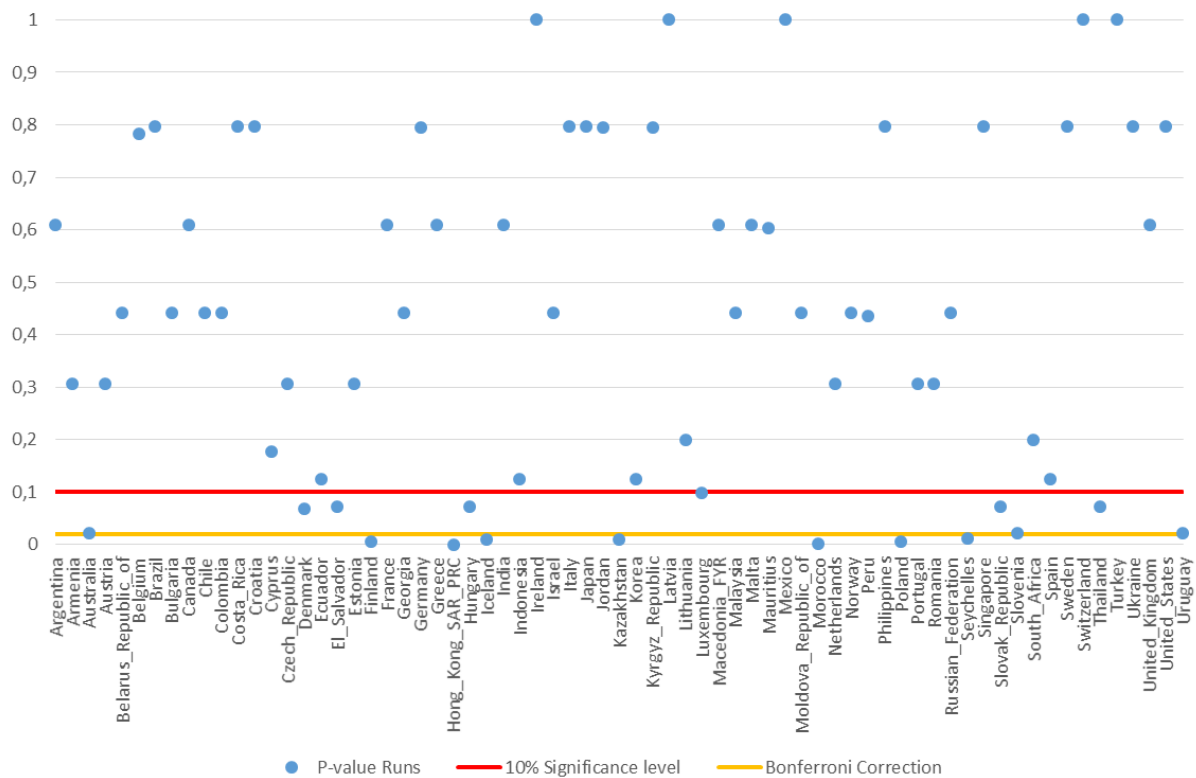
Figure 4.5 - P-Values of Runs Tests

4.2.1.6. Individual Countries

Of the 69 countries, four tested "not random" (i.e. had p-values below the 10% significance level) in four individual tests, three tested "not random" in three tests, nine tested "not random" in two tests and nineteen countries tested "not random" in one of the individual tests. In total 35 out of the 69 countries tested "not random" in one or more category or just about half of the countries using uncorrected 90% confidence level.

However, to diminish the risk of type I errors, where a true null hypothesis is incorrectly rejected (a "false positive"), Bonferroni correction was applied, by adjusting the significance level by the number of tests being compared or Alfa = 10/5 = 2; 18 countries or 26% of the countries tested as "not random".

4.2.1.7. Conclusions about Randomness

Out of the 333 total tests applied to individual countries using the five different test methods only 29 tests or 8.7% rejected the hypothesis of the series being random with 90% confidence level using Bonferroni correction. Of the total number of countries tested, 18 out of the 69 countries or 26% were "not random" in the sense that they fell below 2% significance level using Bonferroni correction. As Net Errors and Omissions relate to both "errors" and "omissions" it is not easy to generalize too much from these results. However, the results give some credence to the idea that Net Errors and Omissions are generally rather random, and not very systematic, which will though be examined in the next section.

4.2.2. Evidence of Systematic Behavior

Seasonality tests can be used to discover if there is a systematic behavior in Net Errors and Omissions. This is because these tests examine trends and variations from seasonal means in order to discover patterns that can be used to forecast the series. If a pattern appears in a discrepancy item it would indicate that the discrepancies are caused by some regularities in the underlying data. As it is demonstrated in the previous section that only 18 countries out of the 69 exhibited "non-random" characteristics, only these countries were used in the tests for seasonality. Using the JDemetra+ software package, which is officially recognized by EUROSTAT as a software for seasonal adjustment of official statistics[19], four different tests were applied to the data, namely: The test on autocorrelation on seasonal lags, The Kruskal-Wallis test, Tukey Periodogram, and Tests on Regression with Fixed Seasonal Dummies. Outliers were detected, but no adjustments were made for holidays or other country specific attributes. Summarized results of these tests are shown in Appendix III.

4.2.2.1. Tests on Autocorrelations at Seasonal Lags

This test is often referred to as the Ljung-Box test, which checks the correlation between the actual observations and the observations lagged by one and two quarters. If the observations are independent from each other, they are distributed as χ^2. When this hypothesis is rejected, the significant autocorrelation is confirmed, which is a sign of seasonal movements in the series and (Grudkowska, 2015, pp. 109). Only 3 of the 18 countries rejected the null hypothesis, i.e. exhibited evidence of seasonality according to this statistics using 95% confidence level, and two of these countries had a p-value below 1.25% significance level for the Bonferroni correction limits. Figure 4.6 shows the results for the individual countries.
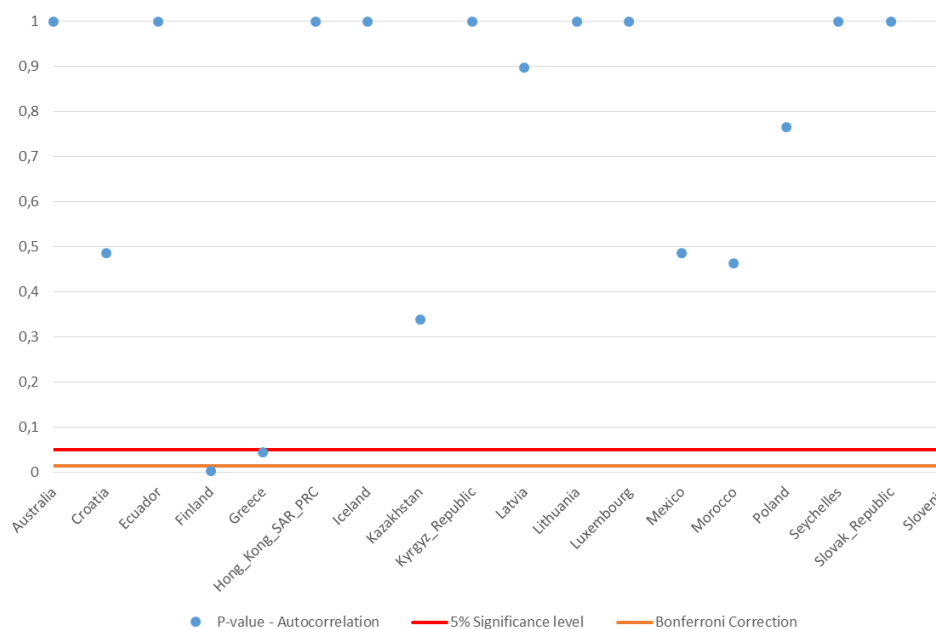
Figure 4.6 - P-Values of Tests on Autocorrelations at Seasonal Lags

4.2.2.2. Non Parametric (Kruskal-Wallis) Test

The Kruskal-Wallis test assumes samples from all periods have the same median. The test statistic has a χ^2 distribution. The null hypothesis states that all months (or quarters, respectively) have the same mean. Of the 18 countries 5 (28%) rejected the null hypothesis, using 95% confidence level, which indicates that there is at least one pair of samples that have different medians. Two of these countries had a p-value below 1.25% significance level for the Bonferroni correction limits. Figure 4.7 shows the results for the individual countries.
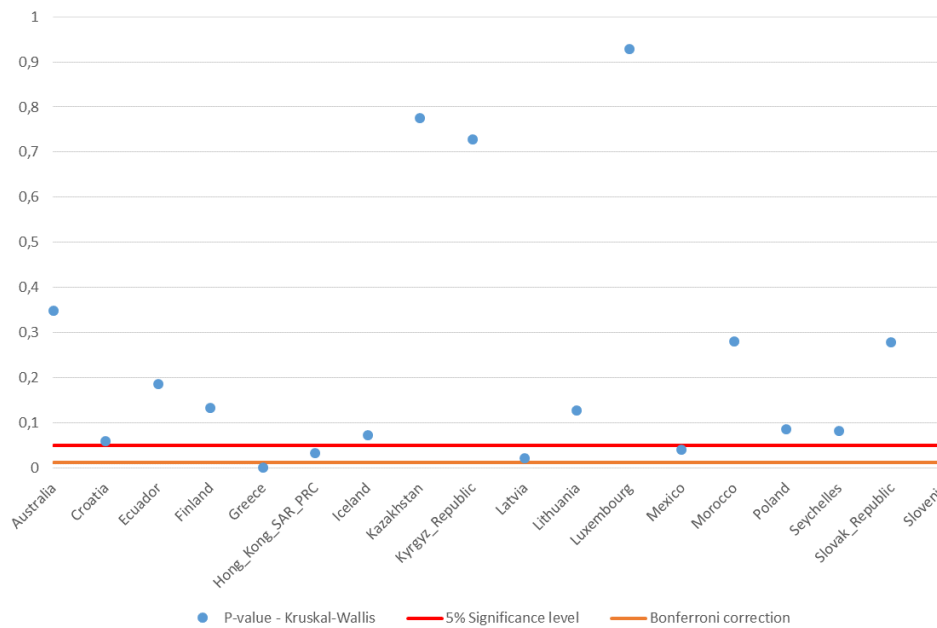
Figure 4.7 - P-Values of Kruskal-Wallis Tests

4.2.2.3. Periodogram

Using Periodogram, which uses a formal test to assess the statistical significance of the periodogram's peaks at the seasonal frequencies. The test proposed is based on the sum of the values of the periodogram at the seasonal frequencies, which follows a χ^2 under the null hypothesis of an absence of seasonality. (Grudkowska, 2015, pp 111-112). In this test 8 degrees of freedom were used. Of the 18 countries, 3 (16.7%) rejected the null hypothesis at 95% confidence level, one of these had a p-value below 1.25% significance level for the Bonferroni correction limits. Figure 4.8 shows the results for the individual countries.
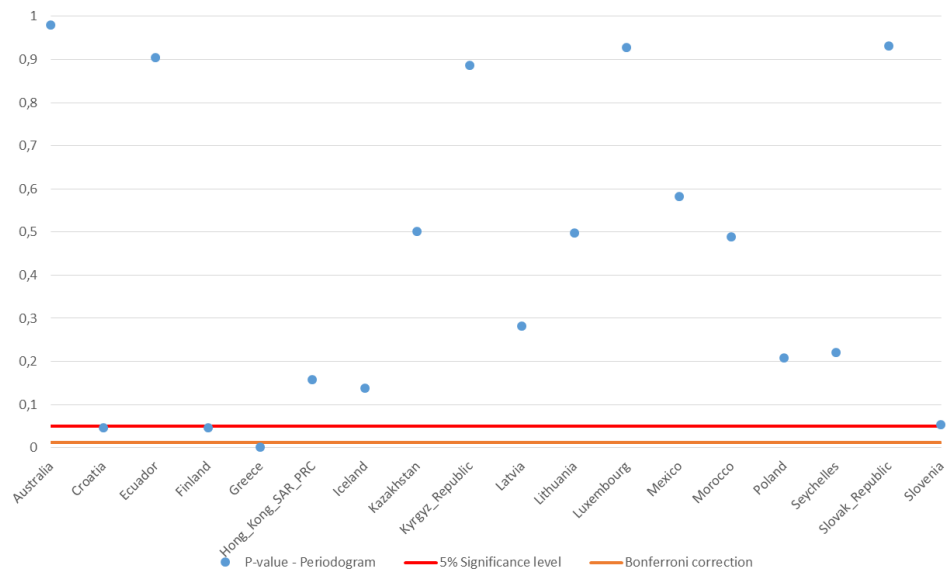
Figure 4.8 - P-Values of Periodogram

4.2.2.4. Tests on Regression with Fixed Seasonal Dummies

This test uses seasonal dummies (4 for quarterly data) to describe the behavior of logarithmically transformed time series, by checking the presence of deterministic seasonality. The test statistics checks if the seasonal dummies are jointly statistically insignificant. When this hypothesis is rejected, it is assumed that the deterministic seasonality is present (Grudkowska, 2015, pp 113). Of the 18 countries tested, 3 (16.7%) tested positive at 95% confidence level, only one a p-value below 1.25% significance level for the Bonferroni correction. Figure 4.9 shows the results for individual countries.
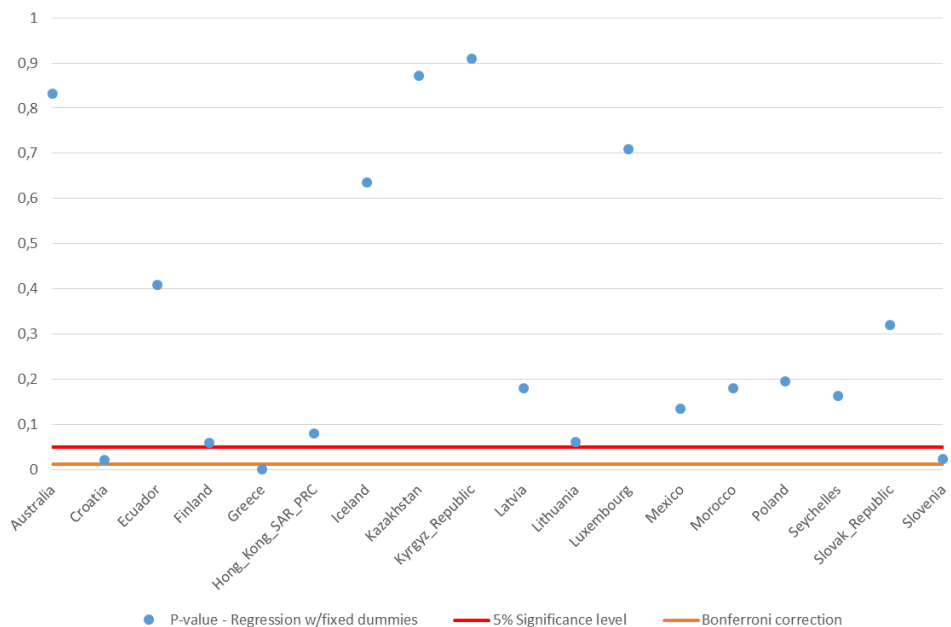
Figure 4.9 - P-Values of Tests on Regression with Fixed Seasonal Dummies

4.2.2.5. Individual Countries

One of these 18 countries had evidence of seasonality using all the four tests, using 95% confidence level, One country had evidence of seasonality using three tests and two countries had evidence of seasonality in two of the tests at 95% confidence level. In total 7 or 39% exhibited seasonality to some extent using 95% confidence level, but after applying Bonferroni correction to the tests only 3 countries rejected the null hypothesis of not exhibiting seasonality.

4.2.2.6. Conclusions on Systematic Behavior

In theory systematic behavior should not be detectible in an error component. However, Net Errors and Omissions contain more than "random errors" and are thus susceptible to other influences. There can also be a positive side to having seasonality in the Net Errors and Omissions, which is that a thorough research into the individual components might lead to clues about the causes of the systematic behavior, giving leads to potential remedies that could alleviate the problem. One additional problem in evaluating seasonality of Net Errors and Omissions might also be the revision policies, which can skew the periodic presentation of the statistics and thus could in theory create a seasonal effect. All in all, seasonality is not a notable problem in Errors and Omissions, only very few countries could benefit from studying the possible causes of seasonality in their Balance of Payments production methods.

4.2.3. Trends

One aspect of Net Errors and Omissions is how it develops in individual countries. Are they succeeding in improving their Balance of Payments statistics by reducing the discrepancies? Are they declining or are they staying more or less the same? To evaluate these issues, Net Errors and Omissions were deflated with the annual GDP (see Fausten & Brooks, 1996) for each country at current prices (data on GDP for individual countries is from the World Bank Database[20]). As Net Errors and Omissions usually oscillate around zero, all values were transformed to positive values and a linear regression was applied to the results. Significance level at 10% was used to categorize if there was a negative or positive slope in the regression. Thus if the p-value of the slope was below the 10% significance level, the sign of the slope decided if the trend was declining (-) or increasing (+). If the p-value was above the 10% significance level, the slope was determined to be indecisive (o). Tables 4.1 - 4.3 show the results of this "test", but it should be observed that in some cases outliers might be influencing the results, for example in the cases of Uruguay and Luxembourg, whereas in India outlier does not change the observed trend. Of the 69 countries tested, using the above described method, 20 tested as having declining trend, 27 as having indecisive trend and 22 as having increasing trend.

The countries in Tables 4.1 - 4.3 were ordered using K-means clustering algorithm on geographical data on the countries. The most obvious conclusion when looking at the geographical distribution is that of the 14 countries that can be described as Asia or Oceania countries 6 have a declining trend according to the test or 43%, where 4 out of 12 American countries have attained decline in Net Errors and Omissions or 33%, whereas for European and African countries, 10 out of 43 or 23% have a declining trend. As the number of countries in the sample is disproportionally distributed with high concentration on Europe the interpretation should be somewhat cautious in drawing too generalized conclusion about the geographical development.

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[20] http://data.worldbank.org/

Country	Slope	P-value	Graph
Belgium	—	0,036	
Georgia	—	0,000	
Israel	—	0,051	
Jordan	—	0,054	
Latvia	—	0,003	
Lithuania	—	0,008	
Macedonia, FYR	—	0,000	
Portugal	—	0,000	
Russian Federation	—	0,000	
South Africa	—	0,001	
Brazil	—	0,000	
Colombia	—	0,000	
Costa Rica	—	0,003	
Ecuador	—	0,000	
Australia	—	0,000	
India	—	0,099	
Indonesia	—	0,014	
Kazakhstan	—	0,013	
Korea	—	0,067	
Singapore	—	0,000	

Table 4.1 – Declining Regression Slope Indicators for Net Errors and Omissions Deflated with GDP
(using 10% significance level)

Country	Slope	P-value	Graph
Armenia	O	0,699	
Belarus, Republic of	O	0,817	
Bulgaria	O	0,135	
Croatia	O	0,964	
Czech Republic	O	0,711	
Estonia	O	0,292	
Greece	O	0,407	
Luxembourg	O	0,131	
Moldova, Republic of	O	0,116	
Morocco	O	0,907	
Poland	O	0,152	
Romania	O	0,417	
Spain	O	0,128	
Switzerland	O	0,182	
Turkey	O	0,755	
Ukraine	O	0,143	
United Kingdom	O	0,895	
Canada	O	0,904	
Chile	O	0,179	
El Salvador	O	0,851	
Mexico	O	0,510	
Peru	O	0,211	
Uruguay	O	0,356	
Hong Kong, SAR, PRC	O	0,811	
Malaysia	O	0,428	
Seychelles	O	0,173	
Thailand	O	0,169	

Table 4.2 – Indecisive Regression Slope Indicators for Net Errors and Omissions Deflated with GDP

Country	Slope	P-value	Graph
Austria	+	0,003	
Cyprus	+	0,000	
Denmark	+	0,000	
Finland	+	0,000	
France	+	0,000	
Germany	+	0,000	
Hungary	+	0,030	
Iceland	+	0,000	
Ireland	+	0,000	
Italy	+	0,000	
Malta	+	0,000	
Netherlands	+	0,000	
Norway	+	0,000	
Slovak Republic	+	0,001	
Slovenia	+	0,000	
Sweden	+	0,000	
Argentina	+	0,002	
United States	+	0,000	
Japan	+	0,000	
Kyrgyz Republic	+	0,002	
Mauritius	+	0,001	
Philippines	+	0,026	

Table 4.3 – Increasing Regression Slope Indicators for Net Errors and Omissions Deflated with GDP (using 10% significance level)

The unadjusted graphs of Net Errors and Omissions for each country, deflated with GDP, can be seen in Appendix IV.

4.3. MULTIVARIATE CHARACTERISTICS OF NET ERRORS AND OMISSIONS

How Net Errors and Omissions relate to other main economic indicators is one avenue of research, for example by observing if changes in the series mirror those of Gross Domestic Production or changes in cross border activities. Studying the development of Net Errors and Omissions in various

contexts can shed light on its properties and potentially highlight commonalities amongst different countries, or not. Relationships with other economic variables could also be valuable, both for possible predictions, or preventions, if there are relationships that can be exploited. As the recent financial crisis is a common subject in discussions on economic affairs the question is asked whether Net Errors and Omissions can predict crisis.

4.3.1. Correlation between Individual Countries

Net Errors and Omissions usually vary quite substantially from one country to another. It can therefore be a worthwhile study to find out if there is correlation between the individual countries. However, since Net Errors and Omissions is a discrepancy item in the double-entry accounting system, drawing strong conclusions from such correlations is more likely to be coincidental than realistic. However, substantial trading between countries and/or similarities of economies could potentially explain some correlation. Using the data on Net Errors and Omissions from the year 2000, correlation was calculated using the R package and using available values without penalizing the whole series for missing items. Figure 4.10 and 4.11 show only the correlations that are significant at 95% confidence level and are setup only using the diagonal values, so as not to repeat each value. The most interesting measurements are explained in callout balloons. The highest positive correlation was observed between Brazil and India at 0.56 which is labelled in Figure 4.10, with Greece and Chile at 0.46, Moldova and Armenia at 0.45 and El Salvador and the Czech Republic also 0.45.
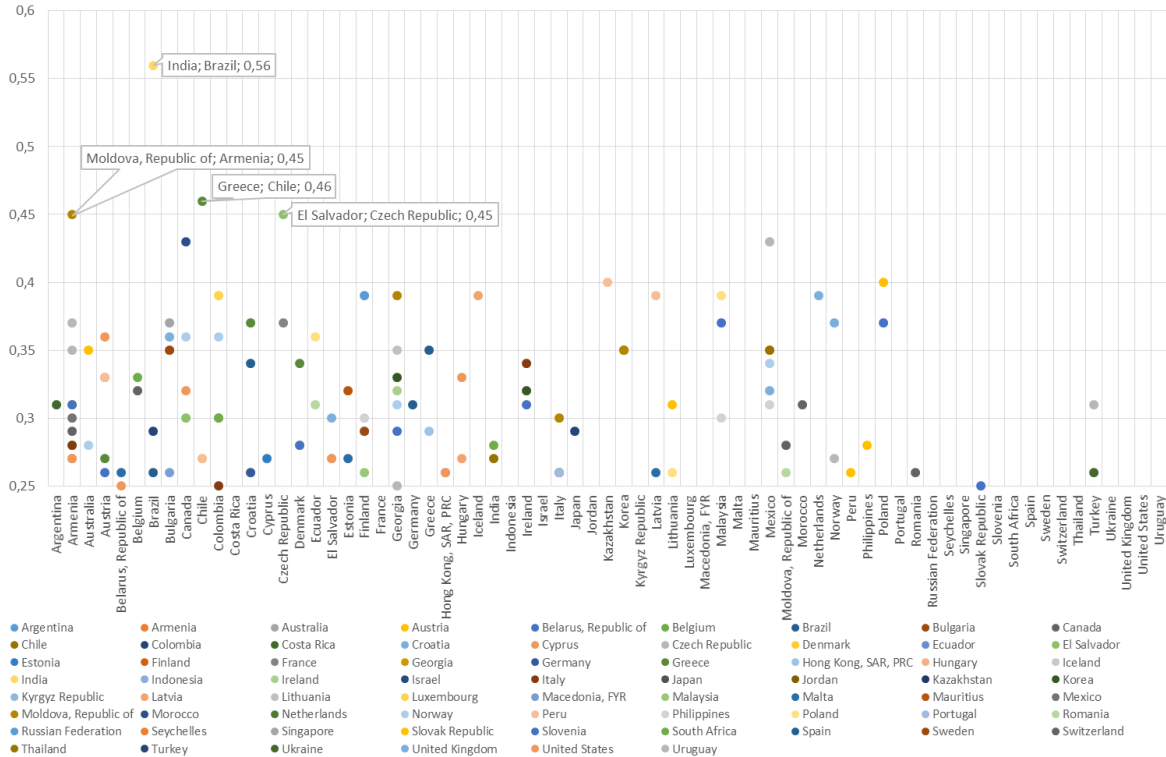
Figure 4.10 - Positive Correlation of Net Errors and Omissions between Individual Countries

High negative correlation should, in theory, be more interesting as that could indicate a potential for researching possible linkages between the countries in question with regard to items that might be underreported in one country against the other. But, unless cross-border ties between the countries

in question are extremely strong, it goes against common sense to read too much into these correlations. The strongest negative correlation of Net Errors and Omissions between two countries is between Belarus and Indonesia at 0.53, Ukraine and Hong Kong, SAR, PRC at 0,49 followed by Moldova and Brazil, Philippines and Latvia, and South Africa and Kazakhstan at 0.46 as shown in Figure 4.11.
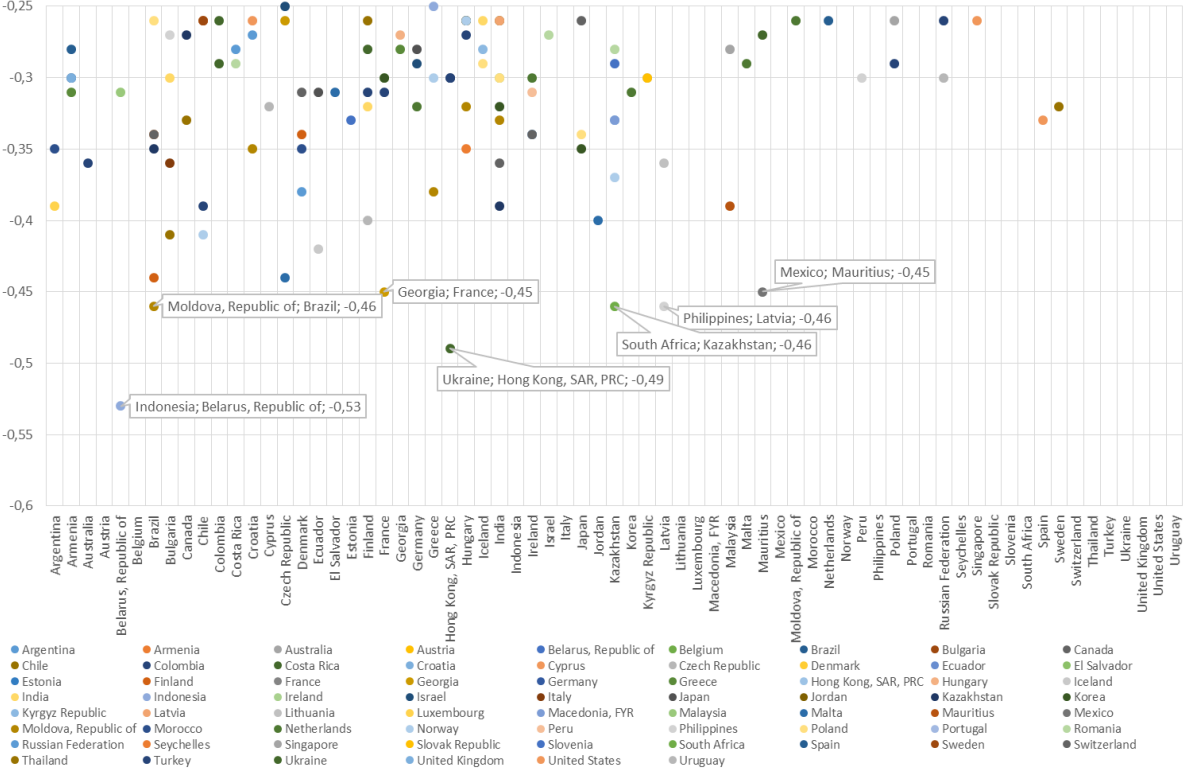
Figure 4.11 - Negative Correlation of Net Errors and Omissions between Individual Countries

4.3.2. Relation with Economic Variables

The relationship between Net Errors and Omissions and several types of economic variables could, if it existed, potentially help in decreasing the discrepancy by pinpointing some of the influencing factors, see Tang (2013). If correlations exist with other Balance of Payments and International Investment Position items, that could provide valuable information about these relationships and potentially open up avenues of further research. Exchange rates influence international trade, even though the Balance of Payments accounts exclude its effects. Exchange rate changes are, though accounted for as revaluation item in the International Investment Position Accounts. The relationship between Net Errors and Omissions and exchange rates is tested. Major economic variables such as Gross National Product and Foreign Debt are tested against the development of Net Errors and Omissions to see if there exist relationships that can explain the properties of the discrepancy item.

4.3.2.1. Correlations with Balance of Payments Categories

As Net Errors and Omissions are derived from the individual components of Balance of Payments items these cannot be independent variables, however, it can be enlightening to look into the relationship of these. By examining the correlation between Net Errors and Omissions with all the main components of Balance of Payments accounts it can be observed that on occasion there is a

relatively strong correlation, either positive or negative in certain countries. Only correlations that are significant at 90% confidence level are used in the following research. If the correlation is negative, it could be surmised that something within these categories is influencing the creation of errors, whereas high positive correlation might point to problems of counter accounting of these categories.

Table 4.4 summarizes the results of correlating Balance of Payments items against Net Errors and Omissions according to BPM5 in all the individual countries. It is interesting to notice that the highest individual correlations in several categories are rather high in some countries, indicating that there might be a problem, or possibly a solution, by focusing attention on these groups. It is also interesting to notice that the number of times the correlation of individual items is negative is more frequent than to positive correlation, which in itself could indicate a systematic bias in the statistics. As BPM5 has been abandoned it is not of interest in this study to look further into this matter for individual countries. The green color in the last column in tables 4.4 – 4.7 shows the proportion of the number of countries that have more than 50% negative correlation in the category. The red color in columns 2 and 3 in the same tables show the items where the correlation is above 50 or below -50.

| BOP5 | Correlation values | | Number of Countries | | |
	Max	Min	Positive	Negative	% Negative
Goods Exports: F.O.B.	0,34	-0,73	10	6	38%
Goods Imports: F.O.B	0,76	-0,44	12	8	40%
Services: Credit	0,67	-0,68	9	13	59%
Services: Debit	0,56	-0,60	16	10	38%
Income: Credit	0,33	-0,53	12	15	56%
Income: Debit	0,51	-0,63	9	14	61%
Current Transfers: Cre	0,41	-0,48	6	7	54%
Current Transfers: Deb	0,42	-0,64	12	9	43%
Capital Account: Credit	0,62	-0,71	12	18	60%
Capital Account: Debit	0,71	-0,70	18	12	40%
Direct Investment Abroad	0,58	-0,61	12	19	61%
Dir. Invest. In Rep. Econ.	0,68	-0,53	15	13	46%
PI Equity Securities Assets	0,46	-0,58	11	21	66%
PI Debt Securities Assets	0,61	-0,64	12	16	57%
PI Equity Securities Liab	0,24	-0,54	4	9	69%
PI Debt Securities Liab	0,17	-0,43	1	15	94%
OI Mon Auth Assets	0,74	-0,65	5	9	64%
OI Gen Govt Assets	0,59	-0,32	11	8	42%
OI Banks Assets	0,37	-0,43	10	6	38%
OI Other Sectors Assets	0,44	-0,56	11	17	61%
OI Mon Auth Liab	0,52	-0,47	10	10	50%
OI Gen Govt Liab	0,37	-0,52	3	17	85%
OI Banks Liab	0,69	-0,51	13	12	48%
OI Other Sectors Liab	0,36	-0,51	7	13	65%
Finan Derivatives: Assets	0,57	-0,80	11	21	66%
Finan Derivatives: Liabil	0,68	-0,65	19	11	37%

Table 4.4 - Summary of Results for Correlation of Balance of Payments Items (BPM5) against Net Errors and Omissions of Individual Countries until 2009

Table 4.5 summarizes the results of correlating International Investment Position items against Net Errors and Omissions according to BPM5 in all the individual countries. The instances of high negative correlation seem to be more severe than those of high positive correlation, which could be of concern and indicate a systemic bias in the production, either in the data or in estimations. The

highest individual correlations in several categories are rather high in some countries, indicating that there might be a problem or possibly a solution by focusing attention on these groups.

	Correlation values		Number of Countries		
IIP5	**Max**	**Min**	**Positive**	**Negative**	**% Negative**
Direct Investment Abroad	-0,20	-0,80	0	10	100%
PI Equity Securities Assets	-0,24	-0,49	0	8	100%
PI Debt Securities Assets	0,38	-0,48	1	9	90%
OI Mon Auth Assets	0,38	-0,36	2	3	60%
OI Gen Govt Assets	0,26	-0,69	1	5	83%
OI Banks Assets	-0,19	-0,53	0	9	100%
OI Oth Sect Assets	0,32	-0,74	1	10	91%
Reserve Assets	0,33	-0,72	2	11	85%
Finan Derivates: Assets	-0,29	-0,80	0	7	100%
Direct Inv In Rep Economy	-0,18	-0,70	0	10	100%
PI Equity Securities Liab	0,40	-0,68	2	6	75%
PI Debt Securities Liab	-0,21	-0,58	0	9	100%
OI Mon Auth Liab	0,40	-0,45	4	2	33%
OI Gen Govt Liab	0,64	-0,42	4	5	56%
OI Banks Liab	-0,18	-0,83	0	10	100%
OI Oth Sect Liab	-0,26	-0,79	0	10	100%
Finan Derivates: Liabil	-0,29	-0,77	0	7	100%

Table 4.5 - Summary of Results for Correlation of International Investment Position Items (BPM5) against Net Errors and Omissions of Individual Countries until 2009

When looking at the data for the countries according to the BPM6 standard it becomes apparent that there is lesser difference between the number of countries with positive and negative correlations than in the data for BPM5. The number of data points is less, which to some extent can explain the difference. The correlations were in some instances in the range from 0.6-0.8, both positive and negative as can be seen in Table 4.6 and Figure 4.12.

	Correlation values		Number of Countries		
BOP6	**Max**	**Min**	**Positive**	**Negative**	**% Negative**
Goods. Credit (Exports)	0,43	-0,72	12	16	57%
Goods. Debit (Imports)	0,41	-0,71	10	16	62%
Services. Credit (Exports)	0,48	-0,70	6	17	74%
Services. Debit (Imports)	0,41	-0,63	12	13	52%
Primary Income: Credit	0,38	-0,68	9	13	59%
Primary Income: Debit	0,36	-0,67	9	10	53%
Secondary Income: Credit	0,47	-0,58	9	11	55%
Secondary Income: Debit	0,42	-0,72	14	13	48%
Capital Account: Credit	0,39	-0,40	8	8	50%
Capital Account: Debit	0,40	-0,55	7	8	53%
DI Equity & Investment Fund Shares: Assets	0,41	-0,49	7	7	50%
DI Equity & Investment Fund Shares: Liab.	0,57	-0,63	8	10	56%
DI Debt Instruments: Assets	0,42	-0,62	9	7	44%
DI Debt Instruments: Liab.	0,39	-0,76	2	13	87%
PI Equity & Investment Fund Shares: Assets	0,53	-0,43	9	5	36%
PI Equity & Investment Fund Shares: Liab.	0,33	-0,48	2	12	86%
PI Debt Securities: Assets	0,63	-0,43	7	6	46%
PI Debt Securities: Liab.	0,51	-0,62	8	13	62%
PI Financial Derivatives & ESO: Assets	0,50	-0,45	4	3	43%
PI Financial Derivatives & ESO: Liabilities	0,42	-0,54	4	4	50%
PI Financial Derivatives & ESO: Net	0,48	-0,39	5	7	58%
OI Other Equity: Assets	0,75	-0,31	7	1	13%
OI Other Equity: Liab.	0,39	0,33	2	0	0%
OI Credit And Loans From The Imf	-0,34	-0,63	0	3	100%
OI Debt Instruments: Assets	0,77	-0,64	13	9	41%
OI Debt Instruments: Liab.	0,51	-0,48	8	16	67%
OI Reserve Assets	0,52	-0,35	15	3	17%

ESO=Employee Stock Options

Table 4.6 - Summary of Results for Correlation of Balance of Payments Items (BPM6) against Net Errors and Omissions of Individual Countries from 2003
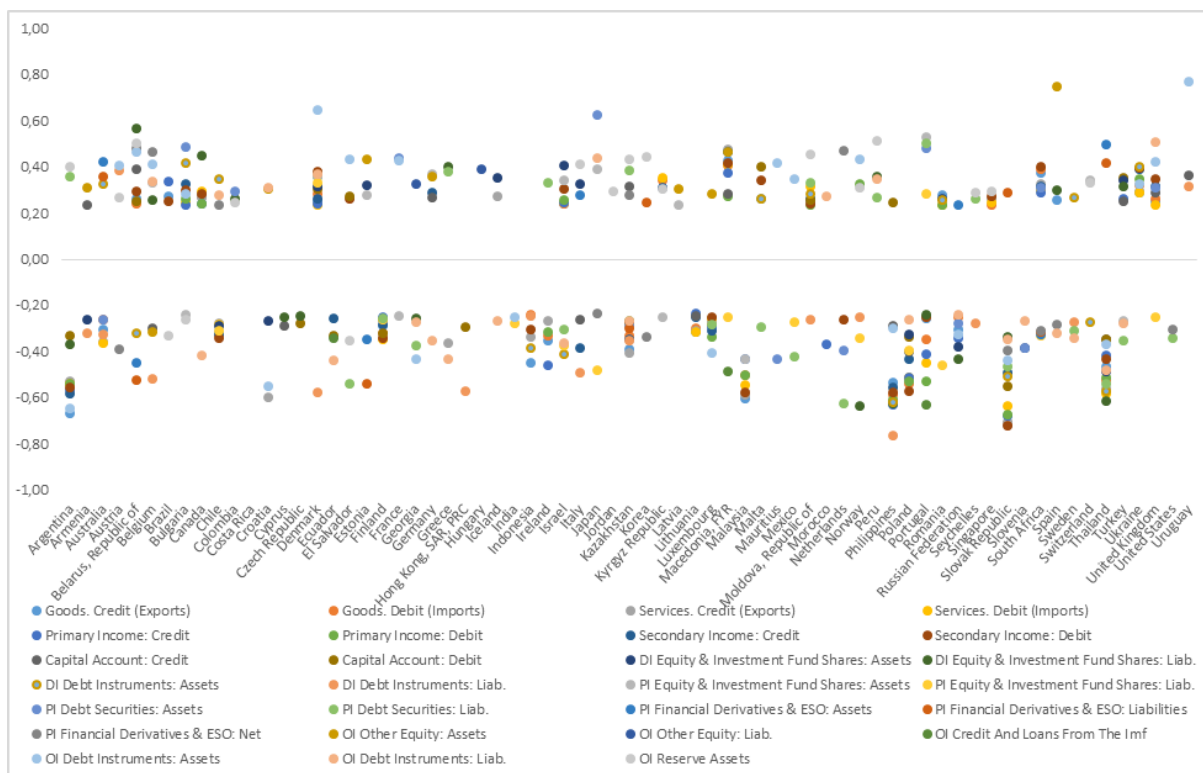
Figure 4.12 – Significant Correlation of Net Errors and Omissions to BPM6 Items for each Country

International Investment Position according to BPM6 data is not materially different with most correlation values between -0.3 and 0.3, although occasional values reach up into -/+0.6 and above. There were large gaps in coverage of individual countries which are shown in Table 4.7 and graphically in Figure 4.13.

IIP6	Correlation values		Number of Countries		
	Max	Min	Positive	Negative	% Negative
DI Equity & Investment Fund Shares: Assets	0,47	-0,69	5	9	64%
DI Equity & Investment Fund Shares: Liab.	0,46	-0,63	7	10	59%
DI Debt Instruments: Assets	0,42	-0,52	6	7	54%
DI Debt Instruments: Liab.	0,47	-0,56	5	7	58%
PI Equity & Investment Fund Shares: Assets	0,71	-0,59	5	9	64%
PI Equity & Investment Fund Shares: Liab.	0,48	-0,52	6	9	60%
PI Debt Securities: Assets	0,66	-0,53	4	10	71%
PI Debt Securities: Liab.	0,46	-0,54	7	7	50%
PI Fin. Deriv. (O.t. Reserves) & ESO: Assets	0,56	-0,54	3	8	73%
PI Fin. Deriv. (O.t. Reserves) & ESO: Liab.	0,35	-0,57	1	8	89%
OI Debt Instruments: Assets	0,49	-0,71	8	9	53%
OI Debt Instruments: Liab.	0,39	-0,63	6	8	57%
OI Reserve Assets	0,45	-0,56	4	6	60%

ESO = Employee Stock Options

Table 4.7 - Summary of Results for Correlation of Balance of Payments Items (BPM6) against Net Errors and Omissions of Individual Countries from 2003
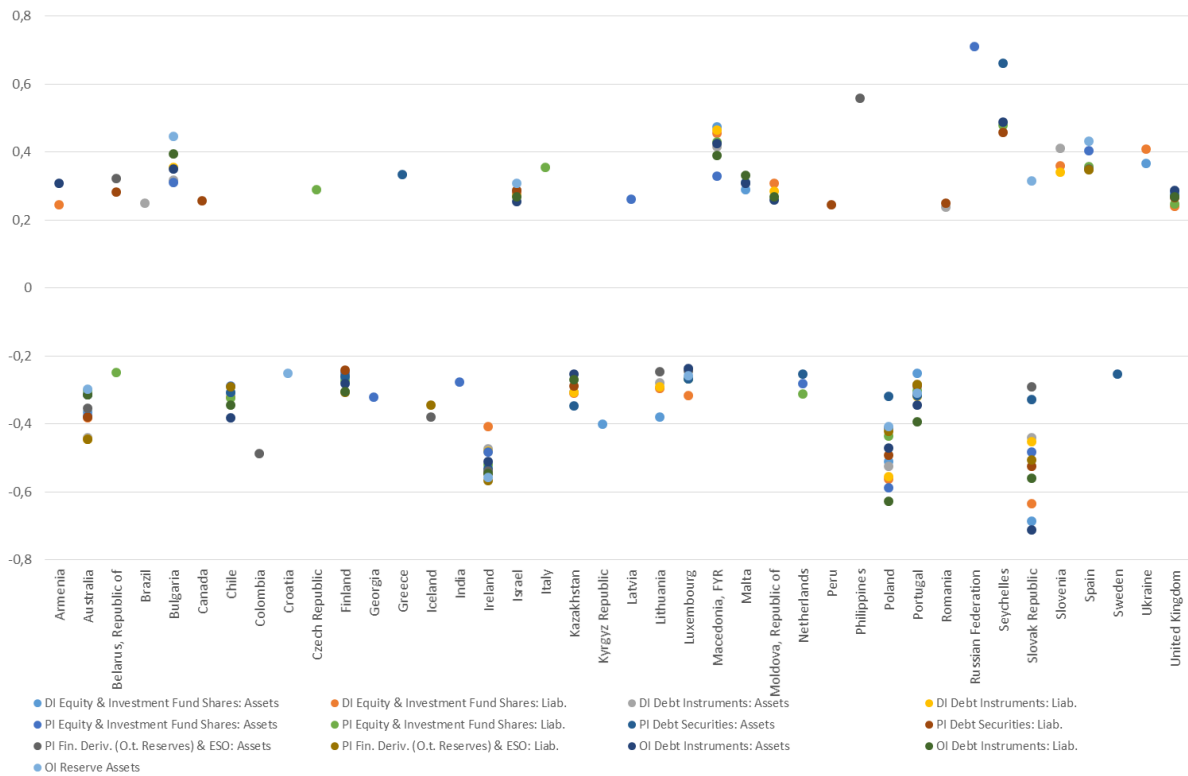
Figure 4.13 – Significant Correlation of Net Errors and Omissions to International Investment Position Items (BPM6) for each Country

4.3.2.2. Correlation with Exchange Rates Changes

One avenue of testing Net Errors and Omissions is to compare its development against changes in exchange rates to see if there are correlations, which might explain the errors. This was done using correlation between Net Errors and Omission and exchange rates of each country against the US Dollar, but yielded no substantial correlation as seen in Figure 4.14 below. Red dots show correlation where statistically significant at 90% confidence level.
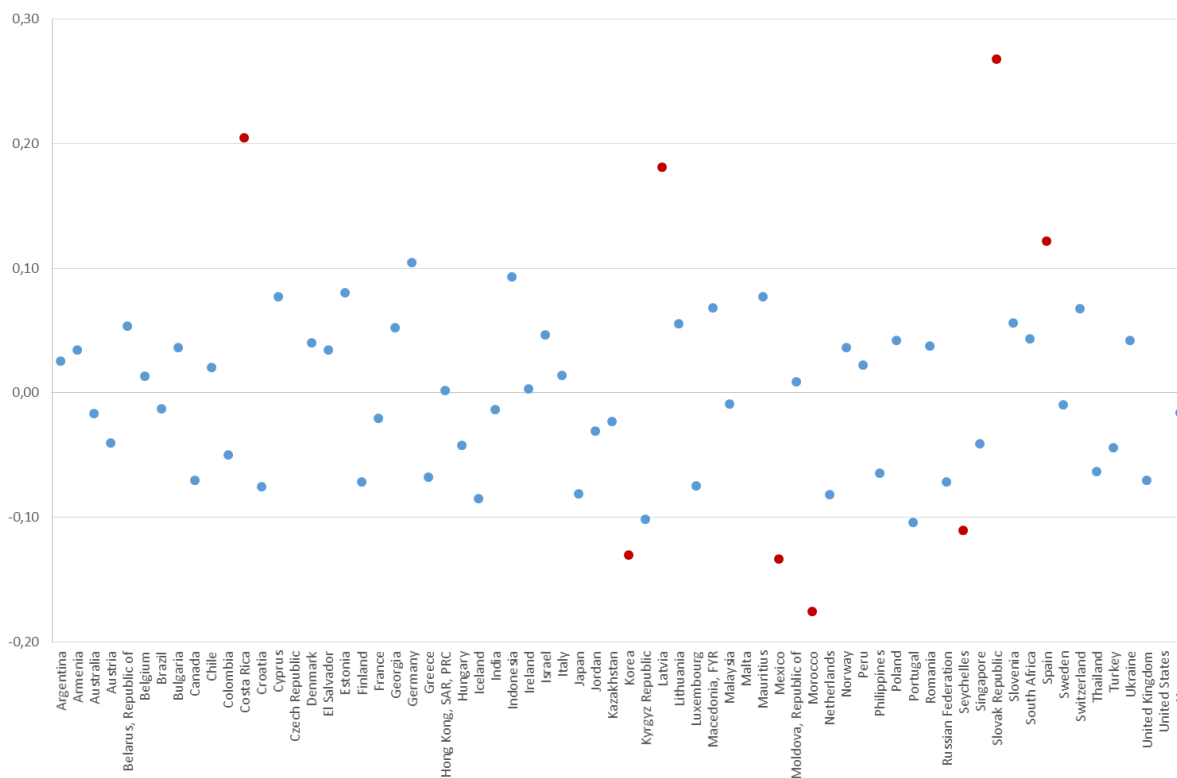
Figure 4.14 - Correlation between Net Errors and Omissions and Exchange Rate Changes (Significant correlation at 90% confidence level is indicated by red dots)

4.3.2.3. Correlation with Major Economic Variables

Net Errors and Omissions is a discrepancy item in the Balance of Payments statistics, which should in theory not be associated with the development of other economic variables. A comprehensive dataset for many economic variables for a multitude of countries at the quarterly frequency is not easy to come by. Therefore, a selection was made out of the IMF data website of several variables that are commonly related to economic development. These include economic growth, production, national income, prices, wages and central bank assets. Correlations were computed for changes (% changes between stock numbers for one period against the next) in the indices and stock values against changes in Net Errors and Omissions where pairwise comparison was possible due to available data, covering periods that ranged from 1997 to 2014. In some cases data was missing and was imputed by averaging. The results of the correlations were mostly in the range of -0.3 – 0.3, with occasional outliers, such as can be seen in the summary Table 4.8, and Figure 4.15 As there is no economic relationship that can explain the negative association of wage rate index of Latvia against Net Errors and Omissions, it can be deemed spurious. The overall result is that even though there was significant correlation (using 90% confidence level) between the tested variables and Net Errors and Omissions in some cases as shown in table 4.8 the correlation was rather low and not uniform as can be seen in Figure 4.15, where the correlations above 90% confidence level are marked with red.

	Max	Min	Avg	St.dev
Real GDP Index	0,28	-0,26	-0,01	0,12
Real GDP Changes	0,27	-0,20	-0,02	0,11
Industrial Production Index	0,26	-0,32	0,01	0,13
National Income	0,23	-0,18	0,01	0,12
Producer Price Index	0,27	-0,23	-0,01	0,11
Wage Rate Index	0,19	-0,67	-0,02	0,17
CPI Harmonized	0,25	-0,18	0,01	0,10
Central Bank Assets	0,52	-0,40	-0,02	0,19
Monetary Base	0,42	-0,16	0,01	0,12

Table 4.8 - Main Results of Correlations of Changes of Economic Variables against Changes in Net Errors and Omissions of Various Countries
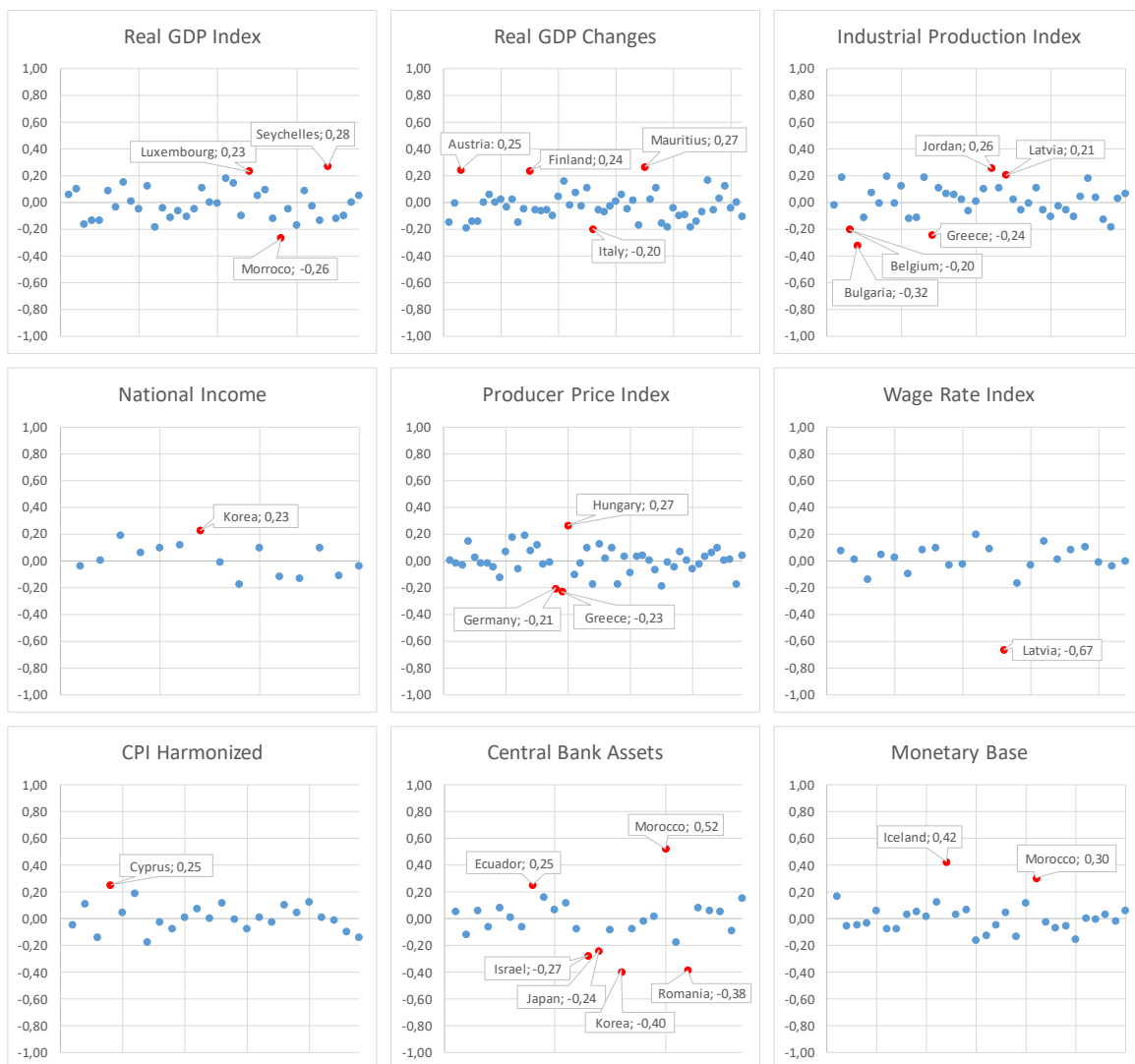
Figure 4.15 – Correlation values of Changes of Economic Variables against Changes in Net Errors and Omissions of Various Countries (red dots show significant correlation using 90% confidence level)

4.3.3. Can Net Errors and Omissions Predict Crisis?

After the 2008 crisis a lot of soul searching took place in order to determine whether prior data could have predicted the financial meltdown in many countries (FSB, 2009; Alessi, Baltussi, Bhein et.al, 2015; Babecký, Havránek, Matějů & Rusnák, 2012). As Balance of Payments development in many instances mirrored the boom preceding the crash the question can be raised whether Net Errors and Omissions could have been used as an early warning indicator. In their 2009 book: "This time it's different", Reinhard and Rogoff analyzed financial crises of the last eight centuries. Their analysis lays the foundations for the methodology of identifying and quantifying financial crisis. One side product was a database of crisis that stretched back many centuries. The database was expanded in a recent paper by Laeven and Valencia in 2013 to include crises that happened after the publication of Reinhard's and Rogoff's book. Crossing the dates of the crises identified with Net Errors and Omissions data for 41 out of the 69 countries that are used in this paper did not yield any meaningful results. An example of this can be seen in Figure 4.16, where relatively long calm period is followed by large swings in Net Errors and Omissions and a subsequent crisis situation.
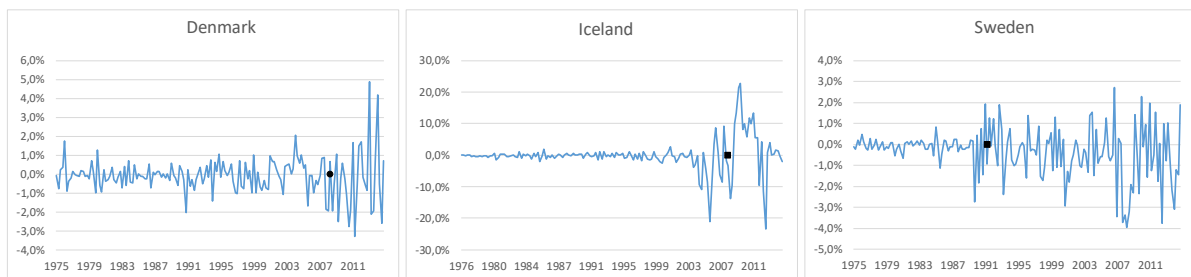
Figure 4.16 - Net Errors and Omissions Appearing to Predict Crisis

However, there are also examples of similar periods of calm and turbulence, which are not followed by crises as seen in Figure 4.17.
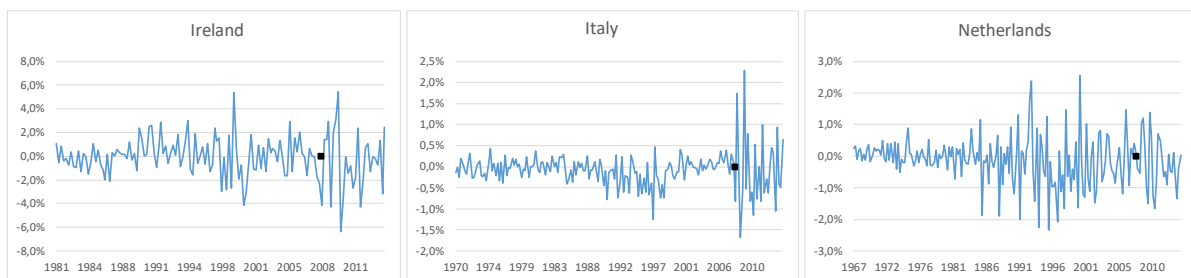
Figure 4.17 - Net Errors and Omissions Giving False Signals of Crises

Thus, the usage of Net Errors and Omissions as an early warning indicator is not reliable and it cannot be used for that purpose.

4.4. REVISION RESEARCH

Revisions to data should in theory be useful as a tool for identifying the most common areas of discovered errors, indicating to producers where the greatest potential was for improvement, but by using revision schedules this history is almost rendered useless, for questionable benefits. Revisions

are corrections to the published statistics that usually happen when better information have been obtained about the items. The revisions can be due to errors on behalf of the data providers, omissions being cleared up, new information that have appeared, changed estimation due to reevaluation by other effects, errors on behalf of the compilers, their systems or changes to methodology. It is a worthwhile exercise to examine the data and see if there is information in the revision history that can shed light on items that need better examination or clues about areas that could benefit from changed tactics in the compilation process that could lead to less errors.

4.4.1. Theory

Frequency, timing and magnitude of revisions to published data can be important sources of information on deficiencies in data collection or production of Balance of Payments and International Investment Position. If a data category has to be frequently updated it indicates that something is amiss. That fact alone should prompt an investigation into data sources and the methodologies of collecting and processing the data. Timing of revisions gives a clue about the reliability of the statistics, such that if revisions stretch over a long period, the accuracy of early numbers may be questionable. Often the nature of individual revisions can in itself give a clue on the source of the problem. Such as if a new data source presents itself via an unexpected canal it should prompt a research into that canal which might lead to other similar sources or data of similar nature. Each compiler can use his/her own history to search for anomalies in revisions. Three main indicators can be processed from revision history:

1. Revision Frequencies; the frequency of revisions which can be measured with the average number of revisions for each country per individual published data category.
2. Revision Magnitudes; the magnitude of individual revisions, probably best measured via the size indicator method described in Damia & Aguilar (2006) pp. 10-12. This also entails using absolute changes as having both positive and negative changes can create spurious results.
3. Revision Timings; the time gap between publishing and revising the published figures. This measure could give indications about period-shifting and other anomalies related to when problems in data are discovered.

Revision policy as mentioned above in chapter 4.1.1 about problems with data, is an important distortion that prevents accurate usage of the revision history data.

4.4.2. Results

Queries were made on the database, where the items that were sought out were isolated and collated where necessary. Excel was used to create tables, often pivot tables. Means, standard deviations and other useful statistical measures were then calculated in order to draw out the common attributes of the data. Principal Components Analysis was considered as a method to try to find more details on relationships between items or countries, but the numerous gaps in data meant that the exercise was not applicable under these circumstances.

The next three sections below contain the results of the study on revisions. The research was done in four categories, i.e. Balance of Payment items according to BPM5 and BPM6 and International Investment Position items according to the both BPM5 and BPM6. The data covers the period from 2003 to 2015 and there is an overlap of BPM5 and BPM6 items. In order to avoid complexities,

netted items and aggregated items were omitted from the study as revisions to these items are reflections of revisions made to the underlying items.

4.4.2.1. Revision Frequencies

The revision frequency is calculated as the number of revisions for each published item for all the countries in the study. For example, for the item "Goods Export: F.O.B." the revisions made to the initial published numbers for 1st quarter of 2003 are counted for individual country, then all the revisions for the initial published numbers for 2nd quarter of 2003 are counted, and so on for all the initial published quarters. Eventually these counting's are processed into the statistics that are shown in tables 4.9 to 4.12 and show the dispersion across all the countries in the study.

Table 4.9 shows the results for Balance of Payments items according to the BPM5. It is notable that in 12 countries, there were 5 or more revisions to the Income items, both credit and debit, where the average of all the countries is 3.36 and 3.75 revisions respectively. Services also have high average frequency of revisions, where 8 countries have a frequency over 5. Obviously the larger number of countries with over 5 in revision frequency pulls the average up. The highest individual revision frequency in one country was in Mexico, 15.81 in the "Direct Investment in Respective Economy". The second highest revision frequency, 10.81 was also in Mexico in the "Income: Debit". The lowest averages are usually in categories where the total number of countries with entries in the category are low. "Goods Exports", "Services: Credit", "Income: Debit", and "Other Investment, Other Sectors Liabilities" are the categories which have the highest of the minimum values, where the number of countries is substantial, which indicates that there is almost always some revisions to these categories.

	Average	St.Dev	Coefficient of Variation	Min	Max	Count	Number of Countries between 10-20 Quarters	Number of Countries above 20 Quarters
BOP5	**7,68**	**2,12**	**0,28**	**4,26**	**14,35**	**69**	**9**	**0**
Goods Exports: F.O.B.	7,78	2,82	0,37	3,98	23,00	68	11	1
Goods Imports: F.O.B	7,73	2,32	0,30	4,50	13,71	69	13	0
Services: Credit	8,00	2,28	0,30	4,46	16,32	69	10	0
Services: Debit	8,16	2,33	0,30	4,96	16,20	69	12	0
Income: Credit	8,18	2,76	0,36	4,10	20,39	69	10	1
Income: Debit	8,06	2,23	0,29	3,83	16,03	69	11	0
Current Transfers: Cre	7,85	2,26	0,29	4,26	14,46	68	13	0
Current Transfers: Deb	7,63	2,32	0,30	3,80	16,08	69	8	0
Capital Account: Credit	7,26	2,06	0,27	3,73	14,56	64	4	0
Capital Account: Debit	7,12	1,86	0,24	4,00	13,67	59	3	0
Direct Investment Abroad	7,59	1,98	0,26	3,64	13,52	68	8	0
Dir. Invest. In Rep. Econ.	7,78	2,06	0,27	3,88	14,03	69	10	0
PI Equity Securities Assets	7,59	2,76	0,36	2,50	16,65	66	9	0
PI Debt Securities Assets	7,56	3,01	0,39	3,00	18,88	65	10	0
PI Equity Securities Liab	7,37	2,81	0,37	2,00	15,52	64	10	0
PI Debt Securities Liab	7,61	2,65	0,35	3,68	17,36	65	9	0
OI Mon Auth Assets	7,40	3,96	0,52	2,00	23,50	46	8	1
OI Gen Govt Assets	7,80	2,97	0,39	3,41	18,36	56	10	0
OI Banks Assets	7,42	3,01	0,39	3,33	17,54	67	11	0
OI Other Sectors Assets	7,89	2,05	0,27	5,25	14,99	68	8	0
OI Mon Auth Liab	8,22	4,10	0,53	2,50	24,73	59	11	1
OI Gen Govt Liab	7,67	2,53	0,33	3,97	14,25	65	12	0
OI Banks Liab	7,56	2,71	0,35	3,81	15,79	67	12	0
OI Other Sectors Liab	7,94	1,94	0,25	5,09	13,63	68	11	0
Finan Derivatives: Assets	6,63	2,50	0,33	3,33	12,81	39	5	0
Finan Derivatives: Liabil	7,02	2,32	0,30	3,00	12,93	47	5	0

Table 4.9 - Revision Frequency for Balance of Payments (BPM5)

Table 4.10 shows the statistics for Balance of Payments according to BPM6. It is interesting to note that the number of countries with revision frequencies above 5 is higher and more frequent than that of the statistics according to BPM5 methodology, which may have more to do with duration of the different methodologies in use as standards, than to changes in the methodology. In the "Primary Income: Debit" category there are 19 countries that have revision frequency above 5. It is also notable that the maximum revision frequency for the individual categories is highest at 10.8 in "Debt instruments: Liabilities" in the Other Investment section for Turkey, with "Equity & Investment Fund Shares: Liabilities" And "Debt instruments: Liabilities" in the Direct Investment Section at 10.4 both for Mexico. "Reserve Assets" seem to be the item that least needs revisions, given the relative number of countries that report this item. It is also notable that "Other Equity" seems to be the least used items by countries in the BPM6 reports.

	Average	St.Dev	Coefficient of Variation	Min	Max	Count	Number of Countries between 10-20 Quarters	Number of Countries above 20 Quarters
BOP6	**13,70**	**4,35**	**0,57**	**6,07**	**23,46**	**69**	**47**	**6**
Goods. Credit (Exports)	13,29	5,65	0,74	4,54	25,09	69	34	10
Goods. Debit (Imports)	13,66	5,66	0,74	4,78	25,27	69	36	11
Services. Credit (Exports)	15,16	5,49	0,71	4,26	25,68	69	37	16
Services. Debit (Imports)	14,79	5,25	0,68	4,96	25,09	69	39	13
Primary Income: Credit	14,70	5,58	0,73	5,27	25,34	69	35	15
Primary Income: Debit	14,89	5,38	0,70	4,13	25,02	69	41	14
Secondary Income: Credit	13,93	5,73	0,75	4,66	25,83	69	37	11
Secondary Income: Debit	13,98	6,13	0,80	3,00	25,49	69	36	11
Capital Account: Credit	15,88	6,96	0,91	3,00	37,50	65	26	23
Capital Account: Debit	18,03	6,26	0,82	3,00	31,20	56	20	28
DI Equity & Investment Fund Shares: Assets	13,21	5,64	0,73	3,57	25,36	65	33	8
DI Equity & Investment Fund Shares: Liab.	12,98	5,73	0,75	3,50	25,39	66	32	10
DI Debt Instruments: Assets	12,42	5,91	0,77	3,00	25,52	61	21	10
DI Debt Instruments: Liab.	12,84	5,63	0,73	3,00	25,70	66	29	11
PI Equity & Investment Fund Shares: Assets	12,84	5,64	0,73	3,50	25,47	64	35	6
PI Equity & Investment Fund Shares: Liab.	12,49	5,84	0,76	3,00	25,15	64	29	7
PI Debt Securities: Assets	12,99	5,69	0,74	2,73	25,45	63	32	6
PI Debt Securities: Liab.	13,61	5,25	0,68	5,51	24,85	64	35	7
PI Financial Derivatives & ESO: Assets	11,39	6,70	0,87	3,00	34,47	41	17	4
PI Financial Derivatives & ESO: Liabilities	10,46	6,07	0,79	3,00	28,24	42	17	2
PI Financial Derivatives & ESO: Net	13,07	6,37	0,83	3,00	30,00	55	28	7
OI Other Equity: Assets	9,17	6,28	0,82	3,00	26,36	19	4	1
OI Other Equity: Liab.	7,51	4,19	0,55	3,50	19,10	14	3	0
OI Credit & Loans From The Imf	10,00	0,00	0,00	10,00	10,00	10	0	0
OI Debt Instruments: Assets	14,61	5,72	0,75	5,11	27,29	68	35	14
OI Debt Instruments: Liab.	14,46	5,35	0,70	5,22	25,08	68	36	14
OI Reserve Assets	14,42	6,58	0,86	4,50	32,00	65	28	13

ESO = Employee Stock Options

Table 4.10 - Revision Frequency for Balance of Payments (BPM6)

Table 4.11 shows the revision frequencies for the International Investment Position according to BPM5. The number of revisions is notably less than for the Balance of Payments items, but that seems to stem from the fact that just about half the countries publish quarterly numbers in that format as opposed to annual numbers. Hence the averages are lower and the maximums seem to be lower also. The most interesting items are: "Other Investments, Other Sector Assets", "Direct Investment in Respective Economy", "Other Investments, Other Sector Liabilities", and "Direct Investment Abroad which have the highest average revision frequencies, the most countries with revisions between 3 and 5 and the highest number of countries above 5 revision, as well as the highest individual maximums. As these are some of the same items that were notable in the Balance of Payments statistics, it can be stated that these items should have called for special attention from compilers, but as these are numbers collected according to the older standard the observation is a bit pointless now.

	Average	St.Dev	Coefficient of Variation	Min	Max	Count	Number of Countries between 10-20 Quarters	Number of Countries above 20 Quarters
IIP5	**7,17**	**2,03**	**0,26**	**3,36**	**13,02**	**46**	**3**	**0**
Direct Investment Abroad	7,39	2,44	0,32	3,00	15,71	44	5	0
PI Equity Securities Assets	6,74	2,11	0,27	3,00	12,09	43	3	0
PI Debt Securities Assets	7,15	2,64	0,34	3,00	17,00	45	5	0
OI Mon Auth Assets	7,76	3,50	0,46	3,00	16,50	28	6	0
OI Gen Govt Assets	7,51	3,25	0,42	3,00	16,50	36	7	0
OI Banks Assets	6,81	2,45	0,32	3,00	12,00	43	7	0
OI Oth Sect Assets	7,53	2,06	0,27	3,71	11,55	44	6	0
Reserve Assets	7,36	3,44	0,45	3,00	16,67	36	7	0
Finan Derivatives: Assets	6,64	2,48	0,32	3,00	13,07	34	3	0
Direct Inv In Rep Economy	7,31	2,17	0,28	3,00	15,38	45	2	0
PI Equity Securities Liab	6,61	1,92	0,25	3,00	11,78	43	2	0
PI Debt Securities Liab	7,63	2,70	0,35	3,00	14,99	43	7	0
OI Mon Auth Liab	7,80	3,95	0,51	3,00	23,50	37	5	1
OI Gen Govt Liab	7,02	2,58	0,34	3,00	13,61	40	5	0
OI Banks Liab	6,73	2,24	0,29	3,00	12,26	43	5	0
OI Oth Sect Liab	7,34	2,06	0,27	3,00	11,92	45	5	0
Finan Derivatives: Liabil	6,66	2,34	0,30	3,00	12,97	34	2	0

Table 4.11 - Revision Frequency for International Investment Position (BPM5)

The revision frequencies for the International Investment Position according to BPM6 are shown in Table 4.12. Revisions in this section seem to be much more common than the same category according to the older standard. Possibly this can be explained as a steeper learning curve for the new format. The highest average frequencies are in the "Debt Instruments: Assets" and "Debt Instruments Liabilities" in the "Other Investments" section, along with the "Equity & Investment Fund Shares: Assets". "Reserve Assets" seem to need the least revisions, which is probably explained by a well-defined and simple item and the requirements on Central Banks of publishing these numbers promptly.

	Average	St.Dev	Coefficient of Variation	Min	Max	Count	Number of Countries between 10-20 Quarters	Number of Countries above 20 Quarters
IIP6	**11,70**	**5,15**	**0,67**	**3,23**	**23,82**	**62**	**29**	**4**
DI Equity & Investment Fund Shares: Assets	11,15	5,74	0,75	3,00	25,33	61	24	5
DI Equity & Investment Fund Shares: Liab.	11,06	5,23	0,68	3,00	25,32	61	26	4
DI Debt Instruments: Assets	10,90	6,07	0,79	3,00	24,21	58	20	7
DI Debt Instruments: Liab.	11,82	6,32	0,82	3,00	31,00	57	19	8
PI Equity & Investment Fund Shares: Assets	11,50	5,97	0,78	3,33	28,14	58	25	6
PI Equity & Investment Fund Shares: Liab.	10,88	5,76	0,75	3,00	24,15	57	22	6
PI Debt Securities: Assets	11,25	5,93	0,77	3,00	27,50	60	26	4
PI Debt Securities: Liab.	11,31	5,71	0,74	3,00	25,18	60	26	6
PI Fin. Deriv. (O.t. Reserves) & ESO: Assets	11,11	6,74	0,88	3,00	30,22	47	17	4
PI Fin. Deriv. (O.t. Reserves) & ESO: Liab.	11,55	6,40	0,83	3,00	27,27	42	18	4
OI Debt Instruments: Assets	12,97	6,11	0,80	3,50	24,73	62	29	9
OI Debt Instruments: Liab.	13,19	6,00	0,78	3,50	25,16	62	28	11
OI Reserve Assets	13,23	6,48	0,84	5,00	27,63	53	17	9

ESO = Employee Stock Options

Table 4.12 - Revision Frequency for International Investment Position (BPM6)

4.4.2.2. Revision Magnitudes

Revision magnitude is the absolute change of the revised number divided by the former number. i.e.

$$\frac{1}{N} \sum_{t=1}^{N} \left| \frac{x_t^j - x_t^i}{x_t^i} \right|$$

Where N is the total number of revisions, x^i is the former number, and x^j is the revised number (see: Damia & Aguilar, 2006, pp. 11). The results of this formula can lead to huge numbers when large changes happen on small principals. The tables below are different from the ones in the previous section as they only show the counts on various intervals.

In Table 4.13, where the revision magnitudes are measured on Balance of Payments items according to BPM5, the most surprising items are Other Investments, "Other Investments, General Government Assets", and "Other Investments, Monetary Authorities Liabilities", which are items that, in theory, should be relatively easy to access. "Portfolio Investment, Debt Securities Assets", even if there are two large changes, seems to be less of a problem. Of the individual countries, Bulgaria was the only country that had more than one item that had changes over 100 times the original, which is always explained by a substantial change to a very low principal value. The most stable items are the Current Account items, where all changes are less than 1 times the original on average in all the countries. The "Transfers" items, were also rather stable as there was one only one country with change in the range of 1 to 10 times.

	Count	less than 1	between 1 and 10	between 10 and 30	between 30 and 50	between 50 and 100	at or above 100
BOP5	**69**	**32**	**36**	**1**	**0**	**0**	**0**
Goods Exports: F.O.B.	68	68	0	0	0	0	0
Goods Imports: F.O.B	69	69	0	0	0	0	0
Services: Credit	69	69	0	0	0	0	0
Services: Debit	69	69	0	0	0	0	0
Income: Credit	69	68	1	0	0	0	0
Income: Debit	69	68	1	0	0	0	0
Current Transfers: Credit	68	66	2	0	0	0	0
Current Transfers: Debit	69	68	1	0	0	0	0
Capital Account.: Credit	63	54	7	1	0	0	1
Capital Account: Debit	59	47	10	1	0	0	1
Direct Investment Abroad	67	49	17	0	0	1	0
Dir. Invest. In Rep. Econ.	69	57	12	0	0	0	0
Pi Equity Securities Assets	63	44	15	1	1	1	1
Pi Debt Securities Assets	65	50	13	0	0	0	2
Pi Equity Securities Liab	64	44	15	4	0	0	1
Pi Debt Securities Liab	65	53	8	3	0	0	1
Oi Mon Auth Assets	43	27	13	3	0	0	0
Oi Gen Govt Assets	53	26	20	1	1	3	2
Oi Banks Assets	66	59	6	0	0	0	1
Oi Other Sectors Assets	68	37	28	3	0	0	0
Oi Mon Auth Liab	57	28	18	7	1	1	2
Oi Gen Govt Liab	65	43	21	1	0	0	0
Oi Banks Liab	67	61	5	1	0	0	0
Oi Other Sectors Liab	68	45	23	0	0	0	0
Finan Derivatives: Assets	39	29	7	2	1	0	0
Finan Derivatives: Liabil	47	33	11	3	0	0	0

Note: Column group "Number of Countries"

Table 4.13 - Revision Magnitude for Balance of Payments (BPM5)

Table 4.14 shows revision magnitudes of Balance of Payments according to BPM6. The Current Account items seem to be the most stable ones, similar to the older standard. "Equity and Investment Fund Shares: Assets" stands out as the only item with three countries with revision magnitudes above 100 times. "Debt Instruments" in both the Direct Investments and the Other Investments are also subject to some revisions. Two countries have two changes over 100 times, Belarus and Kyrgyz Republic. When comparing the Balance of Payments statistics between the two different standards, there is in fact very small difference between them, for example when the average proportion of the items that is less than 1, it is 79% for the BPM5 items and 80% for the BMP6 items.

			Number of Countries				
	Count	less than 1	between 1 and 10	between 10 and 30	between 30 and 50	between 50 and 100	at or above 100
BOP6	**69**	**40**	**28**	**1**	**0**	**0**	**0**
Goods, Credit (Exports)	69	68	1	0	0	0	0
Goods, Debit (Imports)	69	68	1	0	0	0	0
Services, Credit (Exports)	69	68	1	0	0	0	0
Services, Debit (Imports)	69	68	1	0	0	0	0
Primary Income: Credit	69	67	2	0	0	0	0
Primary Income: Debit	69	68	1	0	0	0	0
Secondary Income: Credit	69	67	2	0	0	0	0
Secondary Income: Debit	69	67	1	1	0	0	0
Capital Account: Credit	64	53	10	0	1	0	0
Capital Account: Debit	56	46	8	1	0	0	1
DI: Equity & Investment Fund Shares	65	46	17	1	0	0	1
Equity & Investment Fund Shares	66	53	10	2	0	0	1
Debt Instruments: Assets	60	32	23	4	0	0	1
Debt Instruments: Liab.	66	34	27	4	0	1	0
Equity & Investment Fund Shares: Assets	63	40	15	4	0	1	3
Equity & Investment Fund Shares: Liab.	64	52	9	2	0	1	0
Debt Securities: Assets	63	52	9	1	1	0	0
Debt Securities: Liab.	63	47	12	2	0	2	0
Financial Derivatives & ESO: Assets	39	29	9	1	0	0	0
Financial Derivatives & ESO: Liabilities	41	33	8	0	0	0	0
Financial Derivatives & ESO: Net	54	34	18	1	1	0	0
Other Equity: Assets	19	9	8	1	1	0	0
Other Equity: Liab.	11	7	2	0	1	1	0
Credit & Loans From The Imf	10	10	0	0	0	0	0
Debt Instruments: Assets	68	46	20	1	0	1	0
Debt Instruments: Liab.	68	58	10	0	0	0	0
Reserve Assets	65	60	4	1	0	0	0

ESO=Employee Stock Options

Table 4.14 - Revision Magnitude for Balance of Payments (BPM6)

The revision magnitudes for the International Investment Position items are more stable than for the Balance of Payments items. Table 4.15 shows the counts according to BPM5, and there are only three items that have changes above 100 times the principal amount. Just over 92% of the items have changes less than 1 times the original principal.

		Number of Countries					
	Count	less than 1	between 1 and 10	between 10 and 30	between 30 and 50	between 50 and 100	at or above 100
IIP5	**46**	**37**	**9**	**0**	**0**	**0**	**0**
Direct Investment Abroad	44	43	1	0	0	0	0
PI Equity Securities Assets	43	39	4	0	0	0	0
PI Debt Securities Assets	44	43	1	0	0	0	0
OI Mon Auth Assets	25	20	4	0	0	0	1
OI Gen Govt Assets	35	31	2	0	1	1	0
Oi Banks Assets	43	43	0	0	0	0	0
Oi Oth Sect Assets	44	42	2	0	0	0	0
Reserve Assets	36	36	0	0	0	0	0
Finan Derivatives: Assets	32	25	6	1	0	0	0
Direct Inv In Rep Economy	45	45	0	0	0	0	0
Pi Equity Securities Liab	43	43	0	0	0	0	0
Pi Debt Securities Liab	43	42	0	0	0	1	0
Oi Mon Auth Liab	36	28	6	1	0	0	1
Oi Gen Govt Liab	40	39	1	0	0	0	0
Oi Banks Liab	43	43	0	0	0	0	0
Oi Oth Sect Liab	45	45	0	0	0	0	0
Finan Derivatives: Liabil	32	26	4	0	0	1	1

Table 4.15 - Revision Magnitude for International Investment Position (BPM5)

The story for the International Investment Position revision magnitudes is similar for the BPM6 as for the older standard as can be seen in Table 4.16. Over 94% of the items had changes less than 1 times the principal amount.

		Number of Countries					
	Count	less than 1	between 1 and 10	between 10 and 30	between 30 and 50	between 50 and 100	at or above 100
IIP6	**62**	**55**	**6**	**1**	**0**	**0**	**0**
Equity & Investment Fund Shares: Assets	61	56	3	1	0	0	1
Equity & Investment Fund Shares: Liab.	61	57	4	0	0	0	0
Debt Instruments: Assets	58	48	7	2	0	0	1
Debt Instruments: Liab.	57	53	4	0	0	0	0
Equity & Investment Fund Shares: Assets	58	54	3	0	1	0	0
Equity & Investment Fund Shares: Liab.	57	55	1	1	0	0	0
Debt Securities: Assets	60	60	0	0	0	0	0
Debt Securities: Liab.	60	60	0	0	0	0	0
Fin. Deriv. (O.t. Reserves) & ESO: Assets	47	43	4	0	0	0	0
Fin. Deriv. (O.t. Reserves) & ESO: Liab.	43	39	3	0	0	0	1
Debt Instruments: Assets	62	61	1	0	0	0	0
Debt Instruments: Liab.	62	62	0	0	0	0	0
Reserve Assets	53	53	0	0	0	0	0

ESO=Employee Stock Options

Table 4.16 - Revision Magnitude for International Investment Position (BPM6)

4.4.2.3. Revision Timings

Measuring revision timings was done by calculating the average number of months between each revision after the initial publishing of the statistics for all the subsequent publishing's attributed to the same item with the same reference date. This was done for each country and averaged across these for the final results shown in tables 4.17 to 4.20. In total 15 revision lags were researched and the results for the first 5 are shown, but as can be seen in the tables, in some instances revisions tend to tail off, even after one or two revisions. The "Sparklines" show the averages for all the 15 revisions, but they are relative as there is no scale on the y-axis.

Table 4.17 shows the average months between revisions for Balance of Payments items according to BPM5. It is notable that the average time lags for the Current Account items are less than for those of

the Capital- and the Financial Accounts during the first four revisions on average, which can indicate more need to revise the initial published numbers of the Current Account items as opposed to the longer lead time of the other side of the double-entry accounting i.e. payments for the items. The item that seems to be in the least need of revising is the "Monetary Authorities Liabilities", which is not surprising due to the nature of the institutions that account for it. The development of the time lags of "Services: Credit" is very different from the development of most of the other items as initially the intervals are short, and are frequently revised, with a large revision in the fourteenth attempt, with three countries, Argentina, Israel and Malta having these long lags (average of 29 months from the revision before).

The "bell-shape" pattern of the revision lags as seen in the Sparklines in table 4.17 is interesting compared to the "downward slope" pattern seen in table 4.18, which could indicate that the new standard needed more revisions initially compared to the more established older standard.

BOP5	Average					Standard Deviation					Count					Maximum values					Revisions 1-15
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	
Goods Exports: F.O.B.	8	9	11	12	14	8	5	7	7	9	68	60	56	44	34	61	33	42	46	48	
Goods Imports: F.O.B	7	10	11	14	13	4	6	7	11	9	69	63	59	53	31	22	41	42	60	52	
Services: Credit	7	8	11	12	11	4	4	7	10	7	69	66	61	51	45	21	23	47	70	31	
Services: Debit	7	8	11	12	13	4	4	8	7	8	69	67	63	56	48	25	23	59	53	33	
Income: Credit	8	10	12	10	10	7	7	11	6	6	69	65	58	46	39	39	36	60	33	30	
Income: Debit	7	8	9	10	12	4	4	4	5	8	69	65	59	54	47	20	21	19	31	40	
Current Transfers: Cre	8	10	12	11	14	5	6	11	6	9	68	62	56	42	32	28	30	80	26	35	
Current Transfers: Deb	8	9	10	11	13	6	5	5	5	9	69	59	54	43	32	37	27	30	25	36	
Capital Account: Credit	9	11	15	12	11	4	7	13	6	5	64	56	34	24	12	25	43	80	26	20	
Capital Account: Debit	9	10	14	12	12	4	5	10	7	7	59	44	34	20	13	21	22	58	25	27	
Direct Investment Abroad	8	8	10	11	12	5	4	7	7	9	68	58	51	43	37	24	17	37	36	55	
Dir. Invest. In Rep. Econ.	7	8	9	10	11	4	5	4	6	6	69	67	57	52	44	19	27	20	39	33	
PI Equity Securities Assets	10	12	11	12	10	8	9	6	7	6	66	49	39	29	19	40	55	28	39	25	
PI Debt Securities Assets	9	10	12	10	11	7	7	11	4	5	65	52	44	36	22	36	42	64	22	23	
PI Equity Securities Liab	10	11	11	12	13	7	8	7	9	8	63	50	37	29	15	36	37	43	48	31	
PI Debt Securities Liab	9	10	12	11	10	7	7	6	6	5	65	54	45	35	22	40	34	37	27	23	
OI Mon Auth Assets	12	14	15	25		9	9	12	24		46	29	12	3		50	46	40	53		
OI Gen Govt Assets	11	14	16	12	13	7	11	15	4	3	56	45	28	15	7	37	60	80	19	16	
OI Banks Assets	10	12	14	10	12	7	7	13	6	11	67	56	40	22	16	41	40	80	30	47	
OI Other Sectors Assets	7	9	11	9	10	4	5	7	3	8	68	61	56	45	42	24	23	34	20	55	
OI Mon Auth Liab	14	15	11	11	18	11	13	7	9	18	59	39	25	13	3	62	65	31	29	38	
OI Gen Govt Liab	10	13	12	11	13	6	8	9	7	9	65	58	36	27	17	34	40	47	33	35	
OI Banks Liab	10	12	14	14	11	6	7	12	10	5	67	61	46	28	14	35	40	80	47	20	
OI Other Sectors Liab	7	9	10	10	11	5	4	6	5	8	68	65	60	50	40	28	24	35	34	48	
Finan Derivatives: Assets	9	11	15	12	10	5	9	15	11	4	39	31	24	10	6	27	47	61	42	16	
Finan Derivatives: Liabil	9	12	15	12	13	5	7	12	11	6	47	40	30	14	8	24	33	55	47	22	

Table 4.17 - Months between first 5 Revisions for Balance of Payments (BPM5)

As observed in the previous section Current Account items seem to be more in need for revisions than those of the Capital- and Financial Account items.

BOP6	Average					Standard Deviation					Count					Maximum values					Revisions 1-15
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	
Goods. Credit (Exports)	11	10	10	8	7	7	5	5	4	3	69	65	55	45	23	27	26	28	26	12	
Goods. Debit (Imports)	11	10	9	8	8	6	5	5	4		69	66	58	41	22	26	26	28	22	13	
Services. Credit (Exports)	11	9	9	8	7	7	4	6	3	3	69	66	60	47	34	26	27	33	20	12	
Services. Debit (Imports)	11	10	9	8	7	7	5	5	4	4	69	66	59	49	36	26	27	28	22	16	
Primary Income: Credit	11	9	9	8	7	6	5	5	4	3	69	64	53	45	31	26	29	28	22	12	
Primary Income: Debit	11	9	8	8	7	6	4	5	4	3	69	67	59	49	37	26	26	28	22	14	
Secondary Income: Credit	11	10	9	8	8	6	5	5	3	5	69	62	54	38	23	26	25	23	18	19	
Secondary Income: Debit	11	10	9	8	9	7	6	5	3	5	69	57	45	34	21	27	33	23	16	21	
Capital Account: Credit	15	12	10	9	8	8	6	5	4	5	65	46	32	25	16	31	35	27	19	18	
Capital Account: Debit	18	12	10	8	8	8	6	5	3	5	56	46	32	20	12	31	35	27	14	19	
DI Equity & Investment Fund Shares: Assets	11	10	9	9	8	6	5	5	4	3	65	59	45	33	21	26	29	24	22	15	
DI Equity & Investment Fund Shares: Liab.	10	9	9	8	7	6	5	5	4	3	66	61	53	41	25	24	26	28	18	13	
DI Debt Instruments: Assets	11	10	10	9	8	7	5	5	4	3	61	52	38	32	18	24	25	28	22	15	
DI Debt Instruments: Liab.	11	10	9	9	8	7	5	5	5	4	66	59	49	38	21	26	26	27	22	17	
PI Equity & Investment Fund Shares: Assets	12	12	10	10	7	7	6	4	6	4	64	51	30	25	10	26	29	18	24	14	
PI Equity & Investment Fund Shares: Liab.	12	11	10	11	7	8	6	5	5	3	64	49	26	18	10	31	35	21	22	12	
PI Debt Securities: Assets	12	11	10	10	8	7	6	5	5	5	63	55	38	23	13	29	35	29	24	18	
PI Debt Securities: Liab.	13	11	9	10	9	7	6	5	6	5	64	56	41	29	12	31	29	19	29	18	
PI Financial Derivatives & ESO: Assets	12	11	9	8	8	8	6	5	6	7	41	30	14	6	4	29	26	18	19	17	
PI Financial Derivatives & ESO: Liabilities	10	11	9	11	9	7	7	6	6	4	42	27	10	6	3	27	32	20	19	13	
PI Financial Derivatives & ESO: Net	13	12	10	12	10	8	7	5	5	6	55	45	28	15	7	31	33	20	26	21	
OI Other Equity: Assets	7	9				4	3				19	5				19	14				
OI Other Equity: Liab.	7					4					14					15					
OI Credit & Loans From The Imf	23					3					10					25					
OI Debt Instruments: Assets	11	10	9	9	7	6	5	4	4	3	68	66	58	49	30	26	28	22	22	14	
OI Debt Instruments: Liab.	11	9	8	8	8	6	5	4	4	4	68	67	60	50	33	26	26	22	22	19	
OI Reserve Assets	17	13	6	4		9	8	3	3		65	41	10	5		35	35	11	8		

ESO = Employee Stock Options

Table 4.18 - Months between first 5 Revisions for Balance of Payments (BPM6)

Table 4.19 shows the time lags between revisions of International Investment Position Items according to BPM5. The lags for items other than those of the Monetary Authorities and Reserve Assets are about 7 – 9 months in most cases. A "bell-shape" pattern can be observe in some of the items.

IIP5	Average					Standard Deviation					Count					Maximum values					Revisions 1-15
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	
Direct Investment Abroad	7	8	9	9	9	4	6	4	3	5	44	39	34	24	17	26	29	20	14	23	
PI Equity Securities Assets	7	8	9	9	11	4	4	5	4	9	43	33	28	18	14	18	22	22	17	36	
PI Debt Securities Assets	8	8	9	11	9	5	3	4	6	6	45	35	27	18	14	21	19	19	25	25	
OI Mon Auth Assets	12	11	19			8	9	16			28	16	3			35	33	38			
OI Gen Govt Assets	9	11	14	17	8	6	7	9	15	4	36	26	18	12	4	35	32	35	59	12	
OI Banks Assets	8	10	11	13	15	5	5	6	10	14	43	30	22	11	4	25	25	33	31	36	
OI Oth Sect Assets	7	8	8	8	10	3	4	4	4	7	44	39	36	28	21	18	18	22	16	30	
Reserve Assets	10	17	14	14		7	12	6	1		36	16	6	2		36	43	22	15		
Finan Derivatives: Assets	8	10	10	11	7	5	5	5	5	3	34	24	13	8	4	24	20	21	19	11	
Direct Inv In Rep Economy	6	8	9	9	9	4	5	4	4	5	45	41	37	28	20	24	30	21	17	23	
PI Equity Securities Liab	7	8	9	9	12	3	4	6	5	9	43	33	25	13	9	16	18	24	21	36	
PI Debt Securities Liab	8	9	9	10	9	5	7	5	8	7	43	36	29	20	12	27	33	23	41	30	
OI Mon Auth Liab	11	14	15	11		6	6	9	9		37	23	12	3		28	25	35	22		
OI Gen Govt Liab	8	10	10	10	11	5	6	7	5	7	40	30	19	14	9	24	32	38	17	23	
OI Banks Liab	8	10	10	10	7	5	6	5	8	3	43	34	22	13	5	22	27	23	36	13	
OI Oth Sect Liab	6	7	9	9	11	3	4	5	6	10	45	40	36	28	22	16	22	26	31	45	
Finan Derivatives: Liabil	9	10	9	8	7	5	6	3	2	1	34	21	11	5	2	21	23	15	11	7	

Table 4.19 - Months between first 5 Revisions for International Investment Position (BPM5)

Table 4.20 shows the average time lags for the International Investment Position according to the BMP6 framework. Apart from the Direct Investment "Equity & Investment Fund Shares: Assets" the

IIP6	Average					Standard Deviation					Count					Maximum values					Revisions 1-15
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	
DI Equity & Investment Fund Shares: Assets	9	10	9	9	8	6	6	4	4	5	61	53	40	28	17	23	29	22	20	21	
DI Equity & Investment Fund Shares: Liab.	9	9	9	8	8	6	5	4	4	5	61	56	47	31	22	23	28	22	20	21	
DI Debt Instruments: Assets	10	10	10	10	7	7	5	4	5	3	58	50	37	26	12	32	28	22	21	12	
DI Debt Instruments: Liab.	10	9	9	9	7	7	5	4	5	4	57	50	44	32	17	25	28	23	20	18	
PI Equity & Investment Fund Shares: Assets	10	12	10	10	8	6	7	5	5	4	58	47	33	17	9	27	30	22	19	13	
PI Equity & Investment Fund Shares: Liab.	11	11	10	9	8	8	6	5	4	4	57	40	27	17	10	32	29	22	16	14	
PI Debt Securities: Assets	10	11	9	11	10	6	7	5	5	7	60	46	33	17	10	27	35	25	24	27	
PI Debt Securities: Liab.	10	11	10	8	7	7	7	6	5	3	60	47	35	23	14	33	31	27	26	14	
PI Fin. Deriv. (O.t. Reserves) & ESO: Assets	12	12	11	11	6	8	8	6	5	4	47	34	19	8	4	33	34	22	19	11	
PI Fin. Deriv. (O.t. Reserves) & ESO: Liab.	14	13	13	9	9	8	8	6	3	2	42	31	18	6	4	33	36	26	13	12	
OI Debt Instruments: Assets	10	10	9	7	7	5	5	5	4	3	62	56	48	39	29	23	29	28	16	15	
OI Debt Instruments: Liab.	10	9	9	9	6	6	5	5	5	3	62	57	46	41	26	23	22	29	23	12	
OI Reserve Assets	17	13	7			8	9	7			53	24	4			34	35	18			

ESO = Employee Stock Options

Table 4.20 - Months between first 5 Revisions for International Investment Position (BPM6)

4.4.3. Conclusions of the Revision Results

Revisions do support the common belief that the Financial Account present more problems for the producers of Balance of Payments statistics than the Current Account does. This has a lot with the complexities involved, but it is also a feature of the double-entry accounting system, where the Current Account items are usually simpler and errors can be revised sooner, whereas the Financial Accounts items may be split between many different methods and need to be accounted for in different manner according to each.

4.5. SURVEY AMONGST COMPILERS

Studying the statistical footprints of Net Errors and Omissions and the influencing variables has its limits. It may yield information about whether Net Errors and Omissions are related to other items in the Balance of Payments statistics or not, whether there exist trends or associations, but beyond that other methods must be applied. One of the most common methods to broaden the knowledge about a subject is to conduct surveys amongst the experts in the field. For a survey to be considered successful a scientific approach is essential and it should yield reliable results. Real life can sometimes be a bit different and usually poor response rate is the bane of many surveys. For this thesis a survey was conducted, but the response rate was just about a third of those contacted. Even though this diminishes the value of the survey, the results of the questionnaire were in some instances interesting and may give valuable insights into the opinions of the experts in the field.

4.5.1. Methodology

Of the 69 countries in the sample, contact information was available for 64 via the SDDS and SDDS+ information pages with the International Monetary Fund. The survey was conducted using Google Forms in the beginning of January 2016 and reiterated in May. A draft of the survey was tested by experts in Balance of Payments statistics in Iceland and Portugal, which lead to valuable changes to some questions. Responses were given by 22 countries, with further 3 declining participation due to capacity restraints or changes in-house. The survey was split into four sections (Appendix V). The first section consisted of questions on the influences of certain items that created large Net Errors and

Omissions. The second section had questions about actions that could help in decreasing large Net Errors and Omissions. The third section was about reaction to large Net Errors and Omissions and what methods were used, if any, to decrease it further. The final section had a question about revision policy.

4.5.2. Results

The results of the survey were interesting in many ways as can be seen in Appendix V. The respondents rarely used the "N/A or Do Not Know" option and a distinctive pattern appears when the responses are categorized by only those answers that disagreed or agreed. The last two columns in the table show the percentage of the responses took a stance, i.e. that responded with various degree of disagreement or agreement discounting neutrals and NA/Do not know answers.

4.5.2.1. Items Leading to Larger Net Errors and Omissions

The responses to some of the questions about items that lead to larger Net Errors and Omissions were interesting as can be seen in Figure 4.18. The strongest agreement (100% of those who took stance) was for the effects of "incomplete counter accounting", for example goods being correctly accounted for, but payments or financing were not correct. Agreement was also very strong (100%) for "omission" as a large influencing item, or as explained in the question: "item that should be reported is not reported or accounted for in BOP/IIP, e.g. important information is not confirmed or impact is uncertain". There was also strong support for "period shifting" (94.4%) as a major reason for large errors. "Personal transfers" (78.9%), "capital flight" (78.6%), and "incomplete reporting" (76.2%) were also items that were seen as sizable contributors to large Net Errors and Omissions. There was not as much support for "valuations or revaluations" and "illegal activities" as a large explanation for the errors, but some majority agreed these items as explanatory categories. Respondents largely disagreed to "wrong categorizations" (73.7% disagreed of those that took stance) and "errors in numbers" (61.9%) being large influences leading to larger Net Errors and Omissions. There was more or less an even split on "systems not being adequate" and "mistakes or accidents by compilers" as a reason for higher Net Errors and Omissions.
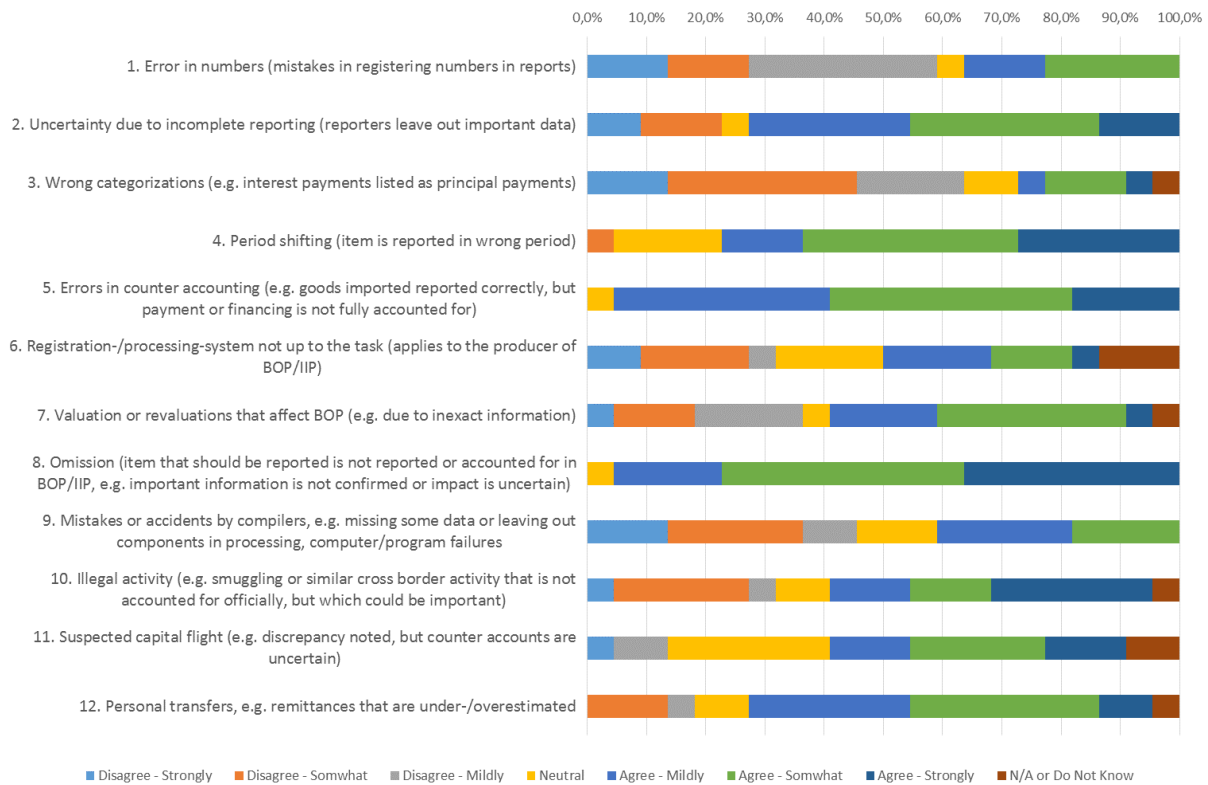
Figure 4.18. - Results of Section 1 of the Survey on Net Errors and Omissions

About 27% of the responses were neutral on "suspected capital flight" as a major contributors to large Net Errors and Omission, just over 18 percent of the respondents were neutral on the questions of "period shifting" and "registration-/ processing systems not being up to task". The latter question had the highest number of "N/A or Do Not Know" responses in Section 1 at 13.6%.

4.5.2.2. Actions that can Aid in Decreasing Large Net Errors and Omissions

It is not surprising that "added resources" top the list of actions that can aid in decreasing Net Errors and Omissions, but there is also a very strong support for "added access to private commercial databases" and "exchanging information with foreign partners. In fact most of the actions suggested in Section 2 had support from the experts. The proportional answers to the questions in Section 2 can be seen in Figure 4.19 It is notable that about 30% of respondents is neutral to "more use of sample surveys", "improved testing of data", "improved management systems", and "reformulating current systems", which could indicate that there is relative satisfaction in areas that can be classified as "current methodology", or perhaps the experts see a limited opportunity for improvement. "Improved testing" had the largest number of "N/A or Do Not Know" responses in Section 2 at 13.6%.
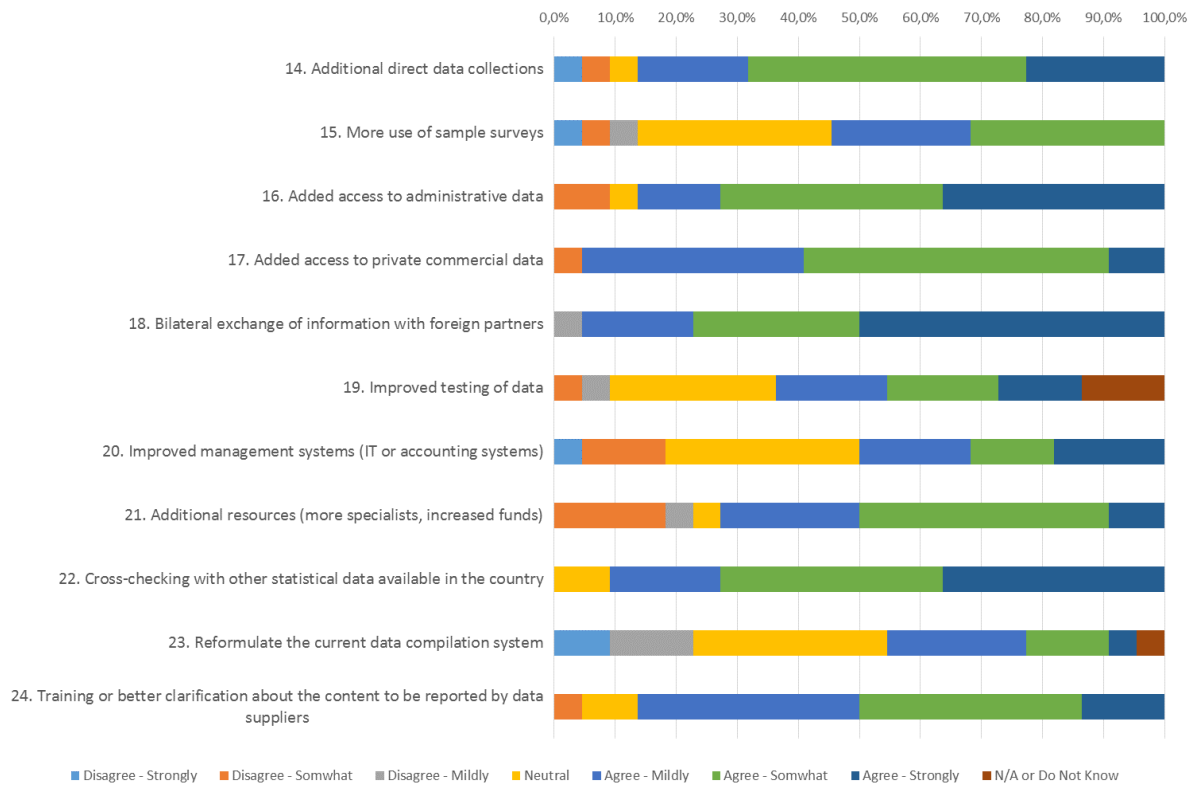
Figure 4.19 - Results of Section 2 of the Survey on Net Errors and Omissions

4.5.2.3. Reactions to Large Net Errors and Omissions

It is interesting to note the differences that appear from the answers to the questions that involve reactions to large Net Errors and Omissions. As can be expected, the unanimous reaction is to "search for the causes and fix". When that fails, the experts resort to different methods. Few, but some, "decrease items or categories proportionally". A bit larger group "adjusts items that historically have been known to cause errors" and an even larger group "adjusts items that seem to be abnormal". More than half has preconceived ideas about potential revisions and adjusts accordingly. If all else fails to explain the larger errors than expected the numbers are published according to best knowledge by most. Figure 4.20 shows the proportionate responses to the questions in Section 3.
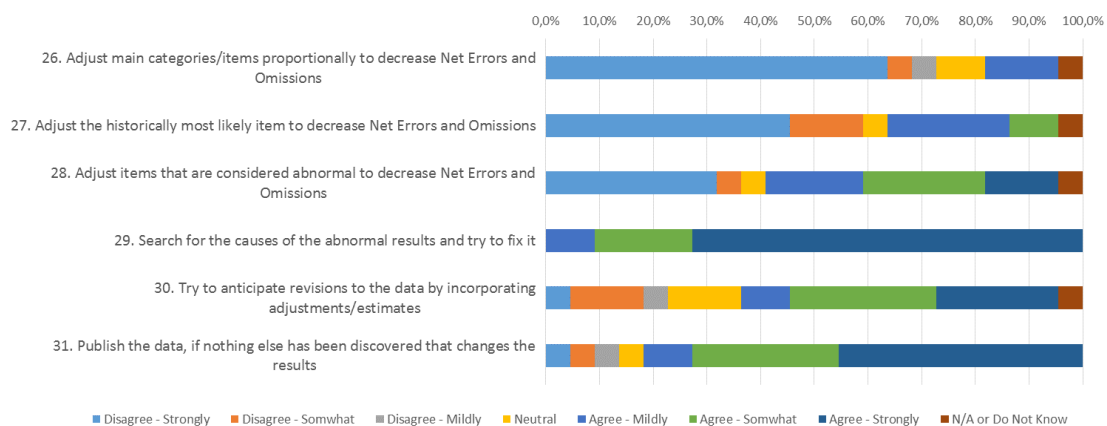
Figure 4.20 - Results of Section 3 of the Survey on Net Errors and Omissions

4.5.2.4. Revision Policy

The last question was aimed at evaluating the proportion of the countries using formal revision policies when publishing Balance of Payments statistics. The reason for asking this question was to potentially cross the participants with the data on revisions to estimate if there was correlation of these countries with "out of sync" relationships in the study on revisions. However, as the participation in the survey was deemed to be too low, this part of the survey was not used any further. Just over 63% of the respondents had formal revision policy, indicating that it is a fairly common practice.

4.5.3. Conclusions of the Survey

The survey shows that the respondents largely seem to share the same opinions in majority of the issues that were the subject, either by commonly agreeing or disagreeing. Incomplete accounting within the double-entry accounting system seems to be one of the most problematic areas in Balance of Payments statistics, not due to the system itself, but the problem of accounting for all the different legs that must be pursued. The suggestion about sharing information among foreign partners receives much support and is probably a very viable method for resolving many of the issues arising from the double-entry accounting system. It is also notable that the experts appear to be rather confident in their own systems and the methodology applied. There are probably no correct or incorrect reactions when Net Errors and Omissions are abnormally high/low, and the BPM6 allows for a multitude of methods when evaluating the individual items. Above all it appears that Balance of Payments compilers are pragmatic and seek solutions to their problems by applying multitude of methods to do so.

As the response rate was only about one third of the proposed sample, it follows that caution must be used when interpreting the results, they only apply to those that responded and other countries may have different opinions that might paint a different picture altogether.

5. CONCLUSIONS

As Net Errors and Omissions are a discrepancy item in the Balance of Payments accounts it usually receives little or no attention, unless it is abnormally high. Therefore, efforts at researching this item have usually been focused on limited aspects or correlations that have been observed in different countries, such as illegal activities that are suspected (see: Schineller, 1997; Adetiloye, 2012; Eggerstedt & Wijnbergen, 1995; Hermes, Lensink & Murinde, 2002; Loungani, & Mauro, 2001; Shi & Lian, 2014), unreported remittances (see: Cali, & Dell'Erba, 2009; Freund & Spatafora, 2005) or technical aspects (see: Blomberg, Forss & Karlsson, 2003; Ghosh, 1997; Damia, & Aguilar, 2006; Duffy & Renton, 1971;) that have affected Net Errors and Omissions. International efforts have also been carried out to identify possible causes of Net Errors and Omissions (International Monetary Fund, 1987) and some research has been conducted on Net Errors and Omissions as an individual item (see: Tang, 2013), and revisions have also been researched (see: Fausten & Brooks, 1996; Tombazos, 2003; Tang, 2009).

Chapters 3.3 to 3.7 are an informal attempt to sketch out a handbook of Net Errors and Omissions, where Causes of Errors (chapter 3.3) are studied. Two sections deal with Balance of Payments Specific Items (chapter 3.4) and International Investment Position Specific Items (3.5). Detection of Errors is studied (chapter 3.6), and eventually one section focuses on Remedies (chapter 3.7). Obviously this work is a rough draft, which could benefit from the insight of other knowledgeable participants, were it to be continued.

This research was set up to address the questions, such as if it was possible to isolate the main causes of Net Errors and Omissions from the revision history of published data; if the results, of the research from published data, resonated with the suggested causes as put forward in the BPM6, and if these causes reflected what the official producers of Balance of Payment statistics believed to be the main causes of Net Errors and Omissions; to how large a degree Net Errors and Omissions exhibited classical behavior of errors in the statistical perspective (randomness, seasonality or trends); and if the development of magnitude of Net Errors and Omissions related to major economic indicators (other Balance of Payments items, International Investment Position items, exchange rates, GDP, price levels, wage levels, production and such, and if they correlated with other countries' Net Errors and Omissions). The answers to these questions are to be found in the paper and the next chapter, but as often in statistical research some of these are not definite or fully answered.

5.1. RESULTS AND DISCUSSION

Discrepancies in statistics are anomalies that often do not receive their due attention. Studies of errors, distributions of errors and residuals are well known in statistical theory, but errors in official statistics, such as Net Errors and Omissions in the Balance of Payments accounts rarely get a mention, apart from the instances that they stand out due to occasional enormity. To some extent this is unwarranted as a thorough study of this item can pave the way for discovering specific causes of these errors and omissions, and possibly contain information on how to improve the offending items and remedy the situation. Complexities, cost restraints and availability of resources will in most cases hamper efforts at eliminating errors and omissions from statistics, but analyzing available data does not have to be very expensive and if that leads to improved results, it is a worthwhile exercise.

As the review of literature shows, important work has been done in this field, both from the analytical perspective and from practical stance. The double-entry accounting system is the foundation of the system, which at the same time is the source of many of the discrepancies that come to light when creating the accounts. However, the double-entry can also hide deficiencies that can take place via cancelling out as mentioned by Kilibarda (2013). Increased information, such as by using exchange rates of the day, instead of using averages can decrease errors as explained by Committeri (2000). Using Net Errors and Omissions as a forecasting variables in trying to estimate capital flight was suggested by Cuddington (1986) and Dooley (1988), but has been contested by Hermes, Lensink & Murinde (2002) and Eggerstedt & Wijnbergen (1995). Using mirror statistics to evaluate potential leakages in goods transactions is suggested by Aktas & Altan (2013). Mirror statistics and exchange of data between compilers in different countries is already been used in some countries and is probably one of the most valuable way of moving the statistics forward to lesser discrepancies. International efforts, such as FATF can also help by changing the environment of businesses and introducing more ethical practices. Better methods of evaluating worker's remittances are advocated by Cali & Dell'Erba (2009), Freund & Spatafora (2005) and Renke (2006).

Statistical methods can be put to good use when attempting to detect potential sources of errors, but systematic approaches and common sense can also be of great help as is discussed in the "handbook" sections, i.e. chapters 3.3 - 3.7. These chapters provide guidance lines for checking for causes of errors, methods for detecting errors by using various approaches, possible remedies, and specific actions for Balance of Payments and International Investment Position items.

The research that is presented in the dissertation is a bit different from many others as it compares time series for a substantial number of countries that adhere to a strict regime (SDDS and SDDS+) of publishing timely data on economic activities. The time series are also relatively long and continuous, but a change of methods in the middle of the period in question throws some spanners in the works, both by curtailing the older data and presenting new series that have shorter histories, even if best efforts have been made in some cases of extrapolating data from newer/older data.

Randomness in Net Errors and Omissions was observed in 74% of the countries that were tested using five different tests at the 90% confidence level. Systematic behavior, such as seasonality offers hope that the sources of errors can be identified as these repeat in some sense. Six countries out of 18 (only those that tested "not random") exhibited evidence of seasonality (at 95% confidence level) in all of the four tests applied, but only 3 countries exhibited evidences of seasonality after applying Bonferroni correction. However, as the appearance of seasonality is no guarantee of finding the offending items it could at least could be used as an initial step in a thorough research in the individual countries.

Some of the correlation analyses, such as of Net Errors and Omissions between countries and against exchange rate changes and major economic variables, proved inconclusive or had highly suspicious relationships, which are very probably spurious, as there are no economical explanations that can justify the high correlation.

Observing trends in the development of Net Errors and Omissions over time in different countries gave varied information, of the 69 countries tested 20 tested as having declining trend, 27 as having indecisive trend and 22 as having increasing trend, thus, less than third had succeeded at decreasing

Net Errors and Omissions and about the same number of countries had experienced worsening of the same.

Correlating individual items of Balance of Payments and International Investment Position against Net Errors and Omissions showed that some countries had high correlation which in some cases could potentially be a subject for further research. It is also interesting to notice that the number of times the correlations of individual items were negative was more frequent than that of positive correlations, which in itself could indicate a systematic bias in the statistics.

Visual inspection of data about crisis plotted against the development of Net Errors and Omissions did not provide any clues as to its usage as an early warning indicator for crisis.

The study of revisions supports the common belief that the Financial Account present more of a problems for the producers of Balance of Payments statistics than the Current Account and Capital Accounts do. This has a lot with the complexities involved, but it is also a feature of the double-entry accounting system, where the Current Account and Capital Account items are usually simpler and errors can be revised sooner, whereas the Financial Accounts items may be split between many different methods and need to be accounted for in different manner according to each. Revision policies impede the usage of revision data as a tool for observation of potential sources of weaknesses in individual items.

The survey amongst the compilers of Balance of Payments shows that they largely share the same opinions on matters relating to identification of problematic areas. Incomplete accounting within the double-entry accounting system seems to be one of the most problematic area in Balance of Payments statistics, not due to the system itself, but the problem of accounting for all the different legs that must be pursued. The suggestion about sharing information among foreign partners receives much support and is probably a very viable method for resolving many of the issues that arise from the double-entry accounting system. It is also notable that the experts appear to be rather confident in their own systems and the applied methodology. As the response rate was only about one third of the proposed sample, it follows that caution must be used when interpreting the results.

5.2. FINAL REMARKS

Net Errors and Omissions are an interesting subject to research. As a balancing item in the Balance of Payments accounts between the sums of the Current- and Capital Account and the Financial Account they represent a failure to harmonize the accounts. In regular accounting, that would not be acceptable and a search would be initiated to find the offending items that caused such a problem. The complexities in accounting properly for transactions across borders are such that this item has become an accepted feature. In this dissertation the focus is on trying to analyze the item and associating other items and variables with it in order to glean information that could lead to a lesser discrepancy. Quite a lot of the analyses turned out to be inconclusive, which was to be expected given the nature of the item. However, some of the commonly held ideas, such as the perceived problems that result from the complexities of the Financial Account seem to be confirmed, but others, such as the belief that over a long period of time Net Errors and Accounts should sum to zero did not pan out. In some countries there were signs that there was high correlation between individual items of the Balance of Payments accounts with Net Errors and Accounts that should warrant some research on whether therein was a potential problem that could lead to lowering of

the errors. The double-entry accounting system is the source of many of the problems that arise in the production of the Balance of Payments accounts, both according to literature and the survey amongst the compilers. Asymmetries between countries have been noted for decades and an exchange of information seems to be the most promising method of decreasing those and fortunately work is under way in some countries to accelerate that process.

5.3. LIMITATIONS AND RECOMMENDATIONS FOR FUTURE WORKS

Data gaps have in some instances proven problematic in the research for this project. In some instances, there are missing data in time series that should be complete, but it is surely very difficult to maintain a database with data from up to 180 countries, with data requirements on different frequencies and a variety of subjects. The data gaps limited the usage of some statistical methods, which rely on complete sets of data to produce reliable results. It might be useful for additional work in this area to improve the IFS databases by filling the data gaps in the historical data series.

As mentioned several times in the text, revision policies are an anachronism that skews official data publications and can invalidate economic research. The author recommends that it should be abandoned. Furthermore the revision policies limit the usage of the potential wealth of information that could be obtained from revision histories.

Poor response rate in the survey that was conducted for this project limits the interpretation of the results.

Work on the "handbook" section could be expanded considerably, but that would call for cooperation of the experts in the field and a board of editors to vet the proposed material. If there is an interest in expanding the work, it would probably be best if some of the international or multinational institutions that are involved in the Balance of Payments field took the initiative and governed the work.

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7. APPENDIX I – DEFINITIONS

Balance of Payments: A statement that summarizes economic transactions between residents and nonresidents during a specific time period. (International Monetary Fund 2009 pp. 7).

International Investment Position: A statement that shows at a point in time the value of: financial assets of residents of an economy that are claims on nonresidents or are gold bullion held as reserve assets; and the liabilities of residents of an economy to nonresidents. (International Monetary Fund 2009 pp. 7).

Other changes in financial assets and liabilities accounts: A statement that shows other flows, such as valuation changes, that reconciles the balance of payments and IIP for a specific period, by showing changes due to economic events other than transactions between residents and nonresidents. (International Monetary Fund 2009 pp. 7).

Current Account: Shows flows of goods, services, primary income, and secondary income between residents and nonresidents. (International Monetary Fund 2009 pp. 9).

Merchanting: The purchase of goods by a resident from a nonresident combined with the subsequent resale of the same goods to another nonresident without the goods being present in the compiling economy" (International Monetary Fund 2014, pp 21)

Primary Income: Shows amounts payable and receivable in return for providing temporary use to another entity of labor, financial resources, or nonproduced nonfinancial assets. (International Monetary Fund 2009 pp. 9).

Retained earnings: Shows the net earnings from production and primary and secondary income transactions before attributing reinvested earnings. It is equal to net operating surplus plus primary income, current transfers receivable, and change in pension entitlements, and minus primary income (excluding reinvested earnings payable to the enterprise's direct investors and owners of investment funds) and current transfers payable. (International Monetary Fund 2009 pp. 188).

Secondary Income: Shows redistribution of income, that is, when resources for current purposes are provided by one party without anything of economic value being supplied as a direct return to that party. Examples include personal transfers and current international assistance. (International Monetary Fund 2009 pp. 9).

Capital Account: Shows credit and debit entries for nonproduced nonfinancial assets and capital transfers between residents and nonresidents. It records acquisitions and disposals of nonproduced nonfinancial assets, such as land sold to embassies and sales of leases and licenses, as well as capital transfers, that is, the provision of resources for capital purposes by one party without anything of economic value being supplied as a direct return to that party. (International Monetary Fund 2009 pp. 9).

Financial Account: Shows net acquisition and disposal of financial assets and liabilities. (International Monetary Fund 2009 pp. 9).

8. APPENDIX II – RESULTS OF TESTS FOR RANDOMNESS

Country	Bartels Ratio Test			Cox Stuart test			Difference Sign Test			Mann-Kendall Rank Test			Runs Test						Significant P-values Bonferroni
	Statistic	n	P-value	Statistic	n	P-value	Statistic	n	P-value	Statistic	n	P-value	Statistic	runs	n1	n2	n	P-value	
Argentina	0,38	62	0,706	14	31	0,720	-0,65	62	0,513	-0,18	62	0,860	0,51	34	31	31	62	0,609	
Armenia	1,22	62	0,222	16	31	1,000	-1,09	62	0,275	-0,70	62	0,485	1,02	36	31	31	62	0,306	
Australia	-3,23	62	0,001	14	31	0,720	-0,65	62	0,513	-1,55	62	0,121	-2,31	23	31	31	62	0,021	1
Austria	0,12	62	0,907	17	31	0,720	0,65	62	0,513	0,69	62	0,493	-1,02	28	31	31	62	0,306	
Belarus_Republic_of	0,04	62	0,970	17	31	0,720	1,09	62	0,275	0,22	62	0,822	0,77	35	31	31	62	0,442	
Belgium	-0,37	54	0,709	NA	NA	NA	-1,63	54	0,102	-0,28	54	0,783	-0,27	27	27	27	54	0,784	
Brazil	-0,23	62	0,814	17	31	0,720	-0,22	62	0,827	0,14	62	0,889	0,26	33	31	31	62	0,798	
Bulgaria	-1,08	62	0,280	19	31	0,281	-0,22	62	0,827	-0,16	62	0,870	-0,77	29	31	31	62	0,442	
Canada	1,28	62	0,202	15	31	1,000	0,65	62	0,513	0,55	62	0,580	0,51	34	31	31	62	0,609	
Chile	0,04	62	0,967	19	31	0,281	1,09	62	0,275	0,43	62	0,666	0,77	35	31	31	62	0,442	
Colombia	0,01	62	0,992	14	31	0,720	-1,09	62	0,275	0,39	62	0,693	-0,77	29	31	31	62	0,442	
Costa_Rica	0,56	62	0,578	12	31	0,281	0,22	62	0,827	-1,86	62	0,062	0,26	33	31	31	62	0,798	
Croatia	0,66	62	0,512	19	31	0,281	-3,71	62	0,000	0,46	62	0,649	0,26	33	31	31	62	0,798	1
Cyprus	1,65	57	0,099	NA	NA	NA	-1,36	57	0,172	0,70	57	0,483	1,35	34	28	28	56	0,178	
Czech_Republic	0,74	62	0,461	18	31	0,473	0,65	62	0,513	-0,01	62	0,995	1,02	36	31	31	62	0,306	
Denmark	-0,36	61	0,716	NA	NA	NA	0,00	61	1,000	-0,72	61	0,470	-1,82	24	30	30	60	0,068	
Ecuador	-3,20	62	0,001	12	31	0,281	0,22	62	0,827	0,35	62	0,729	-1,54	26	31	31	62	0,124	1
El_Salvador	0,65	62	0,516	19	31	0,281	1,09	62	0,275	1,33	62	0,183	1,79	39	31	31	62	0,073	
Estonia	0,65	62	0,515	17	31	0,720	-0,22	62	0,827	0,49	62	0,623	1,02	36	31	31	62	0,306	
Finland	2,55	62	0,011	16	31	1,000	0,65	62	0,513	-0,81	62	0,419	2,82	43	31	31	62	0,005	1
France	1,01	62	0,311	15	31	1,000	0,22	62	0,827	-0,88	62	0,379	0,51	34	31	31	62	0,609	
Georgia	-0,46	62	0,644	11	31	0,150	0,65	62	0,513	-1,10	62	0,272	-0,77	29	31	31	62	0,442	
Germany	0,09	61	0,928	NA	NA	NA	0,88	61	0,379	-0,10	61	0,921	-0,26	30	30	30	60	0,795	
Greece	0,44	62	0,663	18	31	0,473	-2,84	62	0,005	1,21	62	0,227	0,51	34	31	31	62	0,609	1
Hong_Kong_SAR_PRC	-1,56	62	0,119	16	31	1,000	0,22	62	0,827	0,59	62	0,556	-3,59	18	31	31	62	0,000	1
Hungary	-0,18	62	0,859	14	31	0,720	1,53	62	0,127	-1,03	62	0,305	-1,79	25	31	31	62	0,073	
Iceland	-3,75	62	0,000	21	31	0,071	0,65	62	0,513	1,44	62	0,150	-2,56	22	31	31	62	0,010	1
India	-0,17	62	0,862	15	31	1,000	-0,22	62	0,827	-0,42	62	0,675	0,51	34	31	31	62	0,609	
Indonesia	0,18	62	0,861	14	31	0,720	-1,96	62	0,050	-1,33	62	0,183	-1,54	26	31	31	62	0,124	
Ireland	-0,05	62	0,958	12	31	0,281	-1,09	62	0,275	0,03	62	0,976	0,00	32	31	31	62	1,000	
Israel	-0,37	62	0,711	17	31	0,720	0,22	62	0,827	0,22	62	0,822	-0,77	29	31	31	62	0,442	
Italy	1,85	62	0,064	14	31	0,720	-1,53	62	0,127	-0,64	62	0,524	0,26	33	31	31	62	0,798	
Japan	0,65	62	0,513	19	31	0,281	-0,65	62	0,513	0,88	62	0,379	0,26	33	31	31	62	0,798	
Jordan	0,14	60	0,886	NA	NA	NA	1,55	60	0,121	1,07	60	0,284	-0,26	30	30	30	60	0,795	
Kazakhstan	-3,44	61	0,001	NA	NA	NA	-0,44	61	0,660	-0,12	61	0,901	-2,60	21	30	30	60	0,009	1
Korea	-2,31	62	0,021	11	31	0,150	0,65	62	0,513	-1,06	62	0,288	-1,54	26	31	31	62	0,124	
Kyrgyz_Republic	-1,75	61	0,081	NA	NA	NA	1,76	61	0,078	2,61	61	0,009	-0,26	30	30	30	60	0,795	1
Latvia	-1,32	62	0,187	25	31	0,001	-0,65	62	0,513	2,18	62	0,029	0,00	32	31	31	62	1,000	1
Lithuania	-0,23	62	0,818	7	31	0,003	-1,53	62	0,127	-3,35	62	0,001	1,28	37	31	31	62	0,200	1
Luxembourg	-3,00	54	0,003	NA	NA	NA	0,23	54	0,815	1,87	54	0,061	-1,65	22	27	27	54	0,099	1
Macedonia_FYR	-1,25	62	0,212	19	31	0,281	-1,96	62	0,050	1,38	62	0,168	-0,51	30	31	31	62	0,609	
Malaysia	-1,38	62	0,169	13	31	0,473	0,22	62	0,827	-1,61	62	0,108	-0,77	29	31	31	62	0,442	
Malta	0,83	62	0,406	13	31	0,473	1,53	62	0,127	-0,75	62	0,455	0,51	34	31	31	62	0,609	
Mauritius	1,29	60	0,196	NA	NA	NA	1,55	60	0,121	1,65	60	0,100	0,52	33	30	30	60	0,603	
Mexico	1,78	62	0,076	9	31	0,029	-1,96	62	0,050	-2,44	62	0,015	0,00	32	31	31	62	1,000	1
Moldova_Republic_of	-0,60	62	0,547	17	31	0,720	1,09	62	0,275	0,67	62	0,500	-0,77	29	31	31	62	0,442	
Morocco	2,76	44	0,006	NA	NA	NA	-0,77	44	0,439	0,32	44	0,746	3,05	33	22	22	44	0,002	1
Netherlands	-1,53	62	0,126	13	31	0,473	-1,96	62	0,050	-0,82	62	0,412	-1,02	28	31	31	62	0,306	
Norway	0,88	62	0,380	19	31	0,281	0,22	62	0,827	0,63	62	0,532	0,77	35	31	31	62	0,442	
Peru	0,30	61	0,767	NA	NA	NA	1,32	61	0,187	-0,80	61	0,426	0,78	34	30	30	60	0,435	
Philippines	-0,11	62	0,914	12	31	0,281	-1,53	62	0,127	-1,85	62	0,064	-0,26	31	31	31	62	0,798	
Poland	-4,00	62	0,000	4	31	0,000	-0,65	62	0,513	-4,67	62	0,000	-2,82	21	31	31	62	0,005	1
Portugal	1,89	62	0,059	17	31	0,720	-0,65	62	0,513	0,25	62	0,803	1,02	36	31	31	62	0,306	
Romania	0,53	62	0,594	16	31	1,000	-0,22	62	0,827	0,18	62	0,860	1,02	36	31	31	62	0,306	
Russian_Federation	-0,56	62	0,573	13	31	0,473	0,22	62	0,827	0,20	62	0,841	-0,77	29	31	31	62	0,442	
Seychelles	0,06	42	0,954	NA	NA	NA	2,38	42	0,017	0,66	42	0,509	-2,50	14	21	21	42	0,012	1
Singapore	-0,04	62	0,966	16	31	1,000	0,65	62	0,513	0,71	62	0,477	0,26	33	31	31	62	0,798	
Slovak_Republic	-2,15	62	0,032	4	31	0,000	-0,22	62	0,827	-4,50	62	0,000	-1,79	25	31	31	62	0,073	1
Slovenia	-2,33	62	0,020	9	31	0,029	-0,22	62	0,827	-2,74	62	0,006	-2,31	23	31	31	62	0,021	1
South_Africa	-1,60	62	0,110	14	31	0,720	1,53	62	0,127	1,23	62	0,218	-1,28	27	31	31	62	0,200	
Spain	-1,59	62	0,111	11	31	0,150	-1,09	62	0,275	-0,89	62	0,372	-1,54	26	31	31	62	0,124	
Sweden	0,07	62	0,943	10	31	0,071	0,65	62	0,513	-0,46	62	0,649	0,26	33	31	31	62	0,798	
Switzerland	-0,25	62	0,801	18	31	0,473	-0,65	62	0,513	0,86	62	0,392	0,00	32	31	31	62	1,000	
Thailand	-2,01	62	0,045	14	31	0,720	-0,65	62	0,513	-1,21	62	0,227	-1,79	25	31	31	62	0,073	
Turkey	1,27	62	0,205	17	31	0,720	1,09	62	0,275	1,29	62	0,196	0,00	32	31	31	62	1,000	
Ukraine	0,19	62	0,847	19	31	0,281	-0,22	62	0,827	1,68	62	0,092	-0,26	31	31	31	62	0,798	
United_Kingdom	0,68	62	0,499	16	31	1,000	0,22	62	0,827	0,82	62	0,412	0,51	34	31	31	62	0,609	
United_States	-0,17	62	0,861	18	31	0,473	0,65	62	0,513	1,40	62	0,161	-0,26	31	31	31	62	0,798	
Uruguay	1,96	62	0,050	17	31	0,720	-1,53	62	0,127	0,88	62	0,379	2,31	41	31	31	62	0,021	
No. Significant P-values			9			4			3			6						7	18

Note

Bartels Ratio Test	*Alternative hypothesis: nonrandomness*
Cox Stuart test	*Alternative hypothesis: nonrandomness*
Difference Sign Test	*Alternative hypothesis: nonrandomness*
Mann-Kendall Rank Test	*Alternative hypothesis: trend*
Runs Test	*Alternative hypothesis: nonrandomness*

9. APPENDIX III – RESULTS OF TESTS FOR SEASONALITY

Tests for Seasonality / Country - Original Series		Tests on autocorrelations at seasonal lags 1)				Non parametric (Kruskal-Wallis) test 2)			Periodogram 3)			Tests on regression with fixed seasonal dummies 4)			Significant P-values Bonferroni
		ac(4)	ac(8)	Value	P-value		Value	P-value		Value	P-value		Value	P-value	
Australia	-	-0,2477	-0,1097	0	1	-	3,2886	0,3492	-	2,0142	0,9806	-	0,2905	0,832	
Croatia	-	0,0263	0,1387	1,4416	0,4864	-	7,4056	0,06	?	15,6805	0,0472	?	3,5015	0,0212	
Ecuador	-	-0,0951	-0,1159	0	1	-	4,8143	0,1859	-	3,4359	0,9041	-	0,9786	0,4094	
Finland	+	0,4148	0,1376	12,9714	0,0015	-	5,5962	0,133	?	15,7843	0,0456	-	2,6202	0,0596	1
Greece	?	0,2404	0,1797	6,2397	0,0442	+	17,729	0,0005	+	24,5757	0,0018	+	6,6734	0,0006	1
Hong_Kong_SAR_PRC	-	-0,0342	0,2046	0	1	?	8,7454	0,0329	-	11,8655	0,1573	-	2,3728	0,08	
Iceland	-	-0,018	0,053	0	1	-	6,9592	0,0732	-	12,3145	0,1377	-	0,5724	0,6355	
Kazakhstan	-	0,1804	-0,059	2,163	0,3391	-	1,1062	0,7756	-	5,3345	0,5017	-	0,236	0,8709	
Kyrgyz_Republic	-	-0,1909	-0,1108	0	1	-	1,3034	0,7283	-	2,343	0,8856	-	0,1789	0,9103	
Latvia	-	0,0566	-0,31	0,2159	0,8977	?	9,6017	0,0223	-	9,7592	0,2823	-	1,6847	0,1807	
Lithuania	-	-0,0268	-0,0548	0	1	-	5,6823	0,1281	-	7,3614	0,4982	-	2,6095	0,0604	
Luxembourg	-	-0,2167	-0,0271	0	1	-	0,4568	0,9283	-	3,1077	0,9274	-	0,4621	0,71	
Mexico	-	0,1465	-0,1662	1,4475	0,4849	?	8,3274	0,0397	-	6,5759	0,583	-	1,9318	0,1349	
Morocco	-	0,1762	-0,1617	1,5409	0,4628	-	3,8253	0,281	-	5,4431	0,4884	-	1,7153	0,1802	
Poland	-	0,079	0,0394	0,5339	0,7657	-	6,6091	0,0855	-	10,8934	0,2078	-	1,621	0,1948	
Seychelles	-	-0,0734	0,19	0	1	-	6,7207	0,0814	-	10,6753	0,2208	-	1,8122	0,1624	
Slovak_Republic	-	-0,335	0,031	0	1	-	3,8461	0,2786	-	3,0609	0,9305	-	1,1975	0,3191	
Slovenia	+	0,4248	0,1119	13,0731	0,0014	+	11,748	0,0083	-	15,3484	0,0527	?	3,4458	0,0226	1

1) Distribution: Chi2 with 2 degrees of freedom

2) Based on the rank of the observations

2) Distribution: Chi2 with 3 degrees of freedom

3) Test on the sum of the values of a periodogram at seasonal frequencies
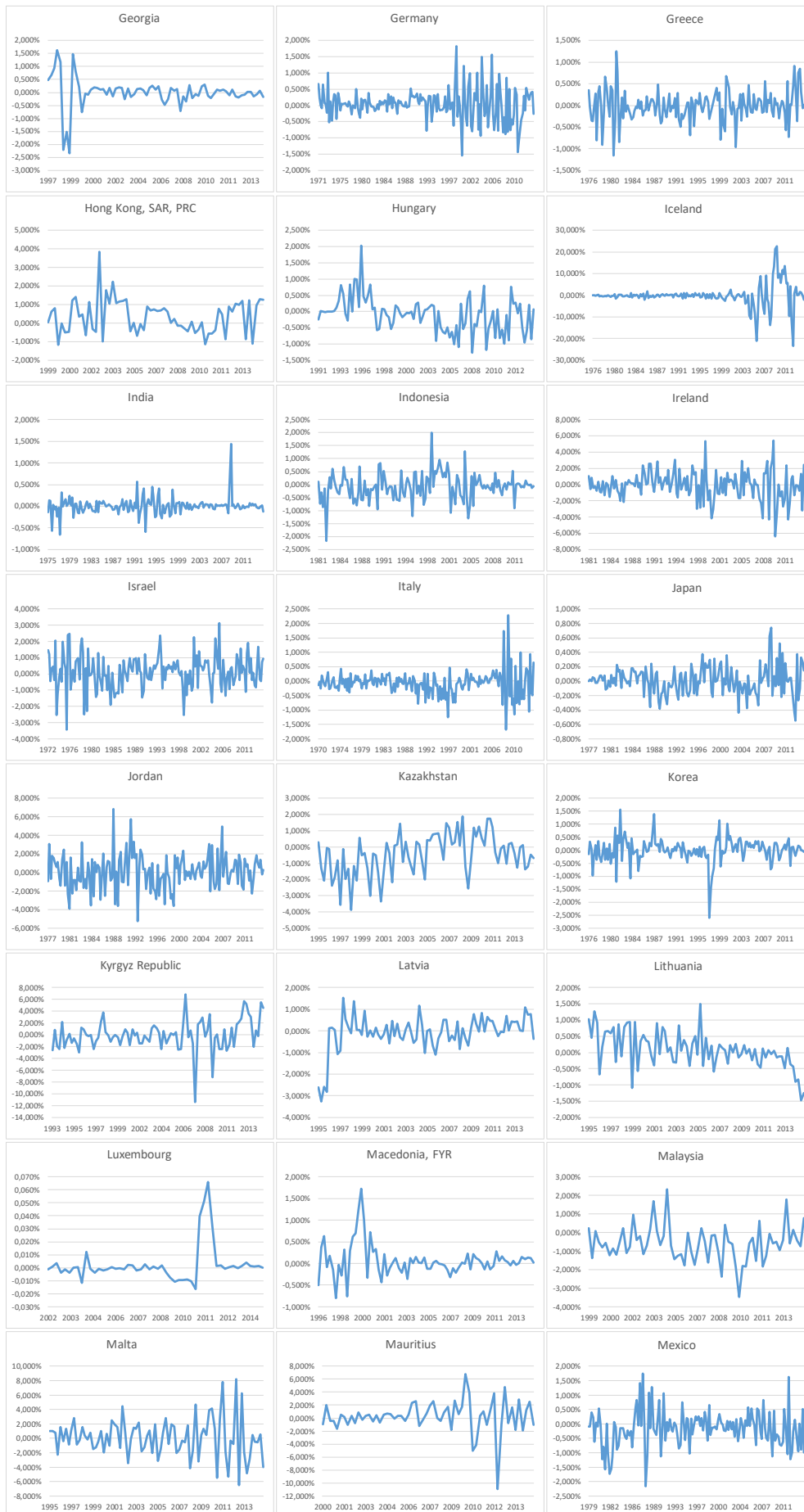
3) Distribution: Chi2 with 8 degrees of freedom

4) Regression model (on original series) with (0 1 1)(0 0 0) noises + mean
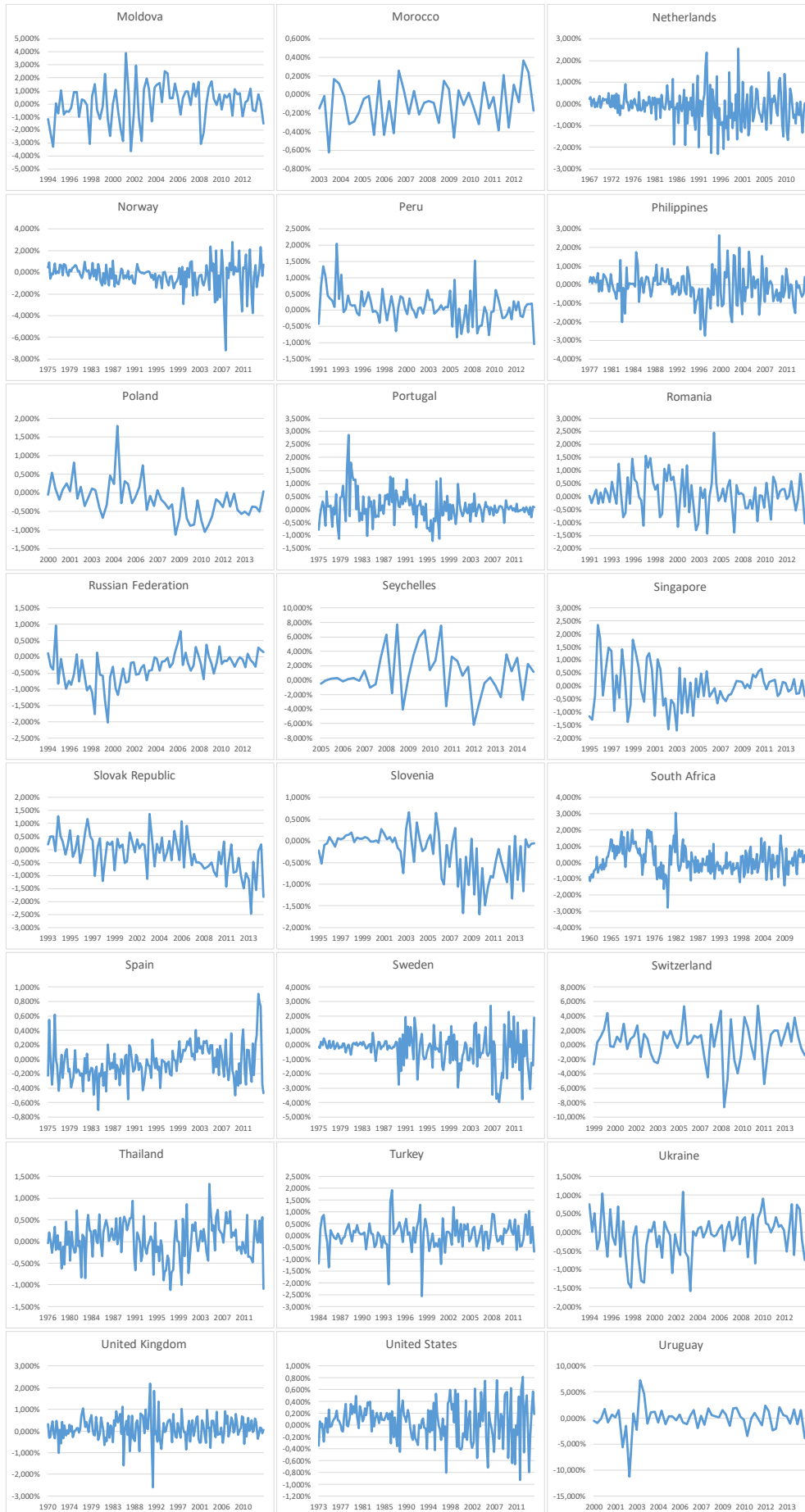
4) Distribution: F with 3 degrees of freedom in the nominator and 56 degrees of freedom in the denominator

10. APPENDIX IV – NET ERRORS AND OMISSIONS IN 69 COUNTRIES

Development of Net Errors and Omissions, deflated with annual GDP.

11. APPENDIX V – RESULTS OF SURVEY ON NET ERRORS AND OMISSIONS

	Disagree			Neutral	Agree			N/A or	%	%
	Strongly	Somwhat	Mildly		Mildly	Somwhat	Strongly	Do Not Know	Disagree	Agree
Section 1: Do you think that the items listed below did contribute to create large Net Errors and Omissions, when considering the period from the beginning of 2010 until today?										
1. Error in numbers (mistakes in registering numbers in reports)	13,6%	13,6%	31,8%	4,5%	13,6%	22,7%	0,0%	0,0%	61,9%	38,1%
2. Uncertainty due to incomplete reporting (reporters leave out important data)	9,1%	13,6%	0,0%	4,5%	27,3%	31,8%	13,6%	0,0%	23,8%	76,2%
3. Wrong categorizations (e.g. interest payments listed as principal payments)	13,6%	31,8%	18,2%	9,1%	4,5%	13,6%	4,5%	4,5%	73,7%	26,3%
4. Period shifting (item is reported in wrong period)	0,0%	4,5%	0,0%	18,2%	13,6%	36,4%	27,3%	0,0%	5,6%	94,4%
5. Errors in counter accounting (e.g. goods imported reported correctly, but payment or financing is not fully accounted for)	0,0%	0,0%	0,0%	4,5%	36,4%	40,9%	18,2%	0,0%	0,0%	100,0%
6. Registration-/processing-system not up to the task (applies to the producer of BOP/IIP)	9,1%	18,2%	4,5%	18,2%	18,2%	13,6%	4,5%	13,6%	46,7%	53,3%
7. Valuation or revaluations that affect BOP (e.g. due to inexact information)	4,5%	13,6%	18,2%	4,5%	18,2%	31,8%	4,5%	4,5%	40,0%	60,0%
8. Omission (item that should be reported is not reported or accounted for in BOP/IIP, e.g. important information is not confirmed or impact is uncertain)	0,0%	0,0%	0,0%	4,5%	18,2%	40,9%	36,4%	0,0%	0,0%	100,0%
9. Mistakes or accidents by compilers, e.g. missing some data or leaving out components in processing, computer/program failures	13,6%	22,7%	9,1%	13,6%	22,7%	18,2%	0,0%	0,0%	52,6%	47,4%
10. Illegal activity (e.g. smuggling or similar cross border activity that is not accounted for officially, but which could be important)	4,5%	22,7%	4,5%	9,1%	13,6%	13,6%	27,3%	4,5%	36,8%	63,2%
11. Suspected capital flight (e.g. discrepancy noted, but counter accounts are uncertain)	4,5%	0,0%	9,1%	27,3%	13,6%	22,7%	13,6%	9,1%	21,4%	78,6%
12. Personal transfers, e.g. remittances that are under-/overestimated	0,0%	13,6%	4,5%	9,1%	27,3%	31,8%	9,1%	4,5%	21,1%	78,9%
Section 2: Do you think that the listed item/action below can contribute to decrease or minimize Net Errors and Omissions?										
14. Additional direct data collections	4,5%	4,5%	0,0%	4,5%	18,2%	45,5%	22,7%	0,0%	9,5%	90,5%
15. More use of sample surveys	4,5%	4,5%	4,5%	31,8%	22,7%	31,8%	0,0%	0,0%	20,0%	80,0%
16. Added access to administrative data	0,0%	9,1%	0,0%	4,5%	13,6%	36,4%	36,4%	0,0%	9,5%	90,5%
17. Added access to private commercial data	0,0%	4,5%	0,0%	0,0%	36,4%	50,0%	9,1%	0,0%	4,5%	95,5%
18. Bilateral exchange of information with foreign partners	0,0%	0,0%	4,5%	0,0%	18,2%	27,3%	50,0%	0,0%	4,5%	95,5%
19. Improved testing of data	0,0%	4,5%	4,5%	27,3%	18,2%	18,2%	13,6%	13,6%	15,4%	84,6%
20. Improved management systems (IT or accounting systems)	4,5%	13,6%	0,0%	31,8%	18,2%	13,6%	18,2%	0,0%	26,7%	73,3%
21. Additional resources (more specialists, increased funds)	0,0%	18,2%	4,5%	4,5%	22,7%	40,9%	9,1%	0,0%	23,8%	76,2%
22. Cross-checking with other statistical data available in the country	0,0%	0,0%	0,0%	9,1%	18,2%	36,4%	36,4%	0,0%	0,0%	100,0%
23. Reformulate the current data compilation system	9,1%	0,0%	13,6%	31,8%	22,7%	13,6%	4,5%	4,5%	35,7%	64,3%
24. Training or better clarification about the content to be reported by data suppliers	0,0%	4,5%	0,0%	9,1%	36,4%	36,4%	13,6%	0,0%	5,0%	95,0%
Section 3: When normal processing of BOP has been completed and Net Errors and Omissions are unusually large, do you?										
26. Adjust main categories/items proportionally to decrease Net Errors and Omissions	63,6%	4,5%	4,5%	9,1%	13,6%	0,0%	0,0%	4,5%	84,2%	15,8%
27. Adjust the historically most likely item to decrease Net Errors and Omissions	45,5%	13,6%	0,0%	4,5%	22,7%	9,1%	0,0%	4,5%	65,0%	35,0%
28. Adjust items that are considered abnormal to decrease Net Errors and Omissions	31,8%	4,5%	0,0%	4,5%	18,2%	22,7%	13,6%	4,5%	40,0%	60,0%
29. Search for the causes of the abnormal results and try to fix it	0,0%	0,0%	0,0%	0,0%	9,1%	18,2%	72,7%	0,0%	0,0%	100,0%
30. Try to anticipate revisions to the data by incorporating adjustments/estimates	4,5%	13,6%	4,5%	13,6%	9,1%	27,3%	22,7%	4,5%	27,8%	72,2%
31. Publish the data, if nothing else has been discovered that changes the results	4,5%	4,5%	4,5%	4,5%	9,1%	27,3%	45,5%	0,0%	14,3%	85,7%
Section 4: Revision Policy for Balance of Payments										
Revision Policy for Balance of Payments										
Yes	63,6%									
No	36,4%									