Monetary policy shocks from the European Central Bank and their impact on goods exports from the non-Eurozone member states

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Kaitlyn Douglass

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This thesis was presented by

Kaitlyn Douglass

It was defended on

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and approved by

James Cassing, PhD, Professor

Shirley Cassing, PhD, Senior Lecturer and Chair of Undergraduate Studies

Chris Papageorgiou, PhD

Thesis Advisor: Steven Husted, PhD, Professor

MONETARY POLICY SHOCKS FROM THE EUROPEAN CENTRAL BANK AND THEIR IMPACT ON GOODS EXPORTS FROM THE NON-EUROZONE MEMBER STATES

Kaitlyn Douglass, BPhil

University of Pittsburgh, 2014

This thesis analyzes the effect a change in the European Central Bank's main refinancing rate has on the export sectors of four Central, Eastern, and Southeastern European member states within the European Union (CESEEU), but who have not yet adopted the euro as their currency. Specifically, the vector autoregression analysis (VAR) econometric technique is employed to elucidate the intensity and time it takes for such a monetary policy shock to be transmitted into these economies, and through which channel: financial or trading. The results, which are interpreted against the Mundell-Fleming framework, show that transmission in Bulgaria and Lithuania works through the finance channel, while the trade channel is responsible for transmission in Poland and the Czech Republic. Transmission speed is fastest in the trade-channel countries, but is most intense in the finance-channel countries. This paper attempts to fill the gap in research explaining how the real economies, specifically the export sectors, of the CESEEU member states are affected by exogenous monetary policy changes undertaken at the ECB level.

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1.0 INTRODUCTION

The successful integration of Central, East, and Southeast Europe (CESEE) with West Europe (WE) into the European Union (EU) has led to a significant increase in spillovers between the regions. This has generally been a beneficial interaction for both, but it has also increased the vulnerability of each region to shocks in the other. These strong spillover-linkages complicate macroeconomic policy-making at the European Central Bank (ECB) level due to the fact that non-euro area economies buffeted by far-away shocks might respond less effectively to its traditional policy tools.

The financial crisis that originated in the US in 2007 was slow to unfold in Europe until the collapse of Lehman Brothers in September 2008. This brought about the peak of the crisis, as risk aversion crippled the financial markets around the world, particularly in WE, which raised the cost of foreign borrowing for CESEE countries within the EU (CESEEU). The US Federal Reserve and the European Central Bank (ECB) quickly adopted policies meant to ease the economic tensions, but to little effect: the impact on WE banks spilled into the CESEEU countries and quickly became a negative feedback loop, permeating the financial and real sectors of the European economies. Not all countries, however, were equally affected. This was due to the heterogeneity of economic structures and conditions in each country. Notably, of all the EU countries, Poland and the Czech Republic escaped relatively unscathed. This was due not only to the big pre-crisis inflows of

WE FDI, but to the fact that both countries have high activity in the manufacturing sector and low activity in the nontradable (financial and service) sectors. Therefore, both countries were able to finance their own manufacturing sectors, as well as import and export trade without relying heavily on crisis-affected WE banks.

It is well known, however, that the Southeast European[1] and Baltic[2] states were the most severely affected by the crisis. Large recovery growth differentials exist between these heterogeneous countries. The Baltic countries took radical steps to restructure their economies and have seen improvements in export growth and domestic demand. On the other hand, the Southeast European states have seen a slower recovery due to a focus on austerity in the midst of the crises.

Countries within the euro area have no ability to determine their own monetary policy adjustments. This meant they had to adopt the blanket monetary adjustment policies set by the European Central Bank (ECB) and integrate them with their own fiscal policies, producing a wide array of policy mixes even across just the euro area countries.

By mandate, the ECB's aim is to maintain price stability in the medium term. In the face of the financial crisis, this aim remained unchanged. However, the ECB did adopt unprecedented measures by lowering key interest rates while simultaneously intervening in securities markets and increasing bank reliance on ECB funding in order to support the transmission of the lowered interest rate monetary policy to the euro area economy (ECB, 2011). The adjustment of interest rates within the euro area must also have spillovers into the EU economies outside of it. After all, for non-euro area economies, the adjustment in the level of interest rates is also the adjustment in the cost of foreign borrowing, which

[1] Southeast European EU countries: Bulgaria and Romania
[2] Baltic EU states: Estonia, Latvia, and Lithuania

(due to free capital flows) determines their domestic interest rates and factors into decisions about transactions, like trade credit finance to support imports and exports.

The strong financial and trade linkages between the WE and the CESEEU countries are the channels through which euro area monetary policy shocks are transmitted to the small, open economies of the CESEEU region. The study of this transmission (how fast it works and to what extent) is pertinent to the CESEEU countries, which are all obligated by their Europe Agreements to ultimately adopt the euro and join the euro area—and this requires a precise understanding of the speed and extent to which inflation is modified by interest rate instruments. In addition, it is important to determine whether the transmission of monetary policy changes operates differently in the CESEEU countries, as opposed to the WE countries, given that there is a gap in financial sector development between the regions and the fact that ECB takes a homogenous approach to policy may have sharply differing effects on the regions, posing problems for the ECB down the road.

Unfortunately, only a sparse amount of research exists that focuses on the effects of ECB monetary policy changes on the real economies in EU countries still outside the euro area (Jarocinski, 2010; and Coricelli, Balázs, and MacDonald, 2006), and none that exists focusing on the effects on exports. Given that monetary policy has a large potential to affect the exports and the real economy, this thesis takes aims to fill this gap.

2.0 REVIEW OF LITERATURE

The economic and financial relationships between the European Union's euro area and the European Union's newest members have been popular topics of research since the years leading up to the 2004 "Big Bang"[3] accession. More specifically, extensive research and analysis has been dedicated to evaluating the readiness of each new member country to join the Economic and Monetary Union (EMU), as stipulated in each of their accession agreements. Therefore, focus has primarily been on optimum currency area criteria convergence, business cycle synchronization, and dynamics of supply and demand shocks. However, this focus has left another aspect of this area of study largely ignored, and that is the transmission of monetary policy shocks from the euro area to new members still outside of the euro area.

The economies of Central, Eastern, and Southeastern Europe within the European Union (CESEEU) have grown increasingly integrated with Western Europe (WE) since the economic restructuring and liberalization of the CESEEU countries in the early 1990s. During the transition years, the European Union became the most important partner to the CESEEU countries, particularly to the countries of Central Europe (Czech Republic, Hungary, Poland, and Slovakia). The Europe Agreements of the late 1990s promised each

[3] This term is often used to refer to the largest accession so far in EU history: Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia, and Slovenia

CESEEU country full EU membership after fully adapting to EU standards. To date, eleven of these countries have successfully become full EU members (2004: Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovak Republic, Slovenia; 2007: Bulgaria, Romania; 2013: Croatia).

Of the CESEEU countries, the most highly trade-integrated with the euro area are the Czech Republic, Slovakia, Hungary, Estonia, and Slovenia, while Lithuania, exhibits a low level of trade-integration (Eickmeier and Breitung, 2006). Due to high levels of FDI coming from WE and the euro area, the most financially-integrated with the euro area are the Czech Republic, Poland, Slovakia, Estonia and, now, Latvia[4]. While the Czech Republic and Estonia are the most highly integrated in both respects, some CESEEU countries that are less integrated than these two have been found to exhibit higher variance shares in output growth and in inflation due to euro area factors that are similar to euro area countries themselves: these variance shares in Poland, Lithuania, Slovakia, and Hungary range between 28% and 43% for output growth and between 31% and 42% for prices (Eickmeier and Breitung, 2006). In contrast, only 10% of variance shares for inflation in the Czech Republic can be explained by euro area factors (Eickmeier and Breitung, 2006). With the exception of the Czech Republic, however, it seems that the transmission of common euro area demand shocks do not differ between the euro area WE countries and the CESEEU countries (Von Hagen and Traistaru, 2005; Baxter and Kouparitsas, 2005; Imbs, 2004; Kose *et al.*, 2003; and Otto *et al.*, 2001).

[4] This is since the 2008 recession—the EU and the IMF (institutions in which the advanced WE are dominant) worked together to fund Latvia through a total front-loaded restructuralization of its economy and government

2.1 Financial stress transmission and business cycle synchronization

Economic integration between WE and CESEEU consists of shifting to closer ties in both the trading and financial sectors. Trading linkages have grown increasingly close since the economic transition period in the CESEEU in the early 1990's from trading only within the Warsaw Pact to trading with capitalistic countries on the world stage. Financial linkages have also grown since then in the form of foreign direct investment (FDI) flowing into the CESEEU countries from the advanced economies in WE,[5] but also in the form of increasingly developed banking sectors following the lead of the dominant WE-owned banks that cropped up in these countries during privatization during the 1990's (IMF 2011; Marques, 2010; Fidrmuc, Grozea-Helmenstein, Wörgötter, 1999).

These trade and financial linkages support a significant portion of CESEEU countries' economic health, but in doing so they also put these countries in a position of higher susceptibility to the transmission of financial stress during rough economic periods because of the ever-increasing synchronization of business cycles with those of the euro area. Financial stress is a suddenly occurring period of strain on multiple sectors in a financial system, where its ability to intervene is greatly attenuated. Financial stress tends to be associated with large shifts in asset prices, abrupt increases in risk, liquidity droughts, and concerns about banking health (Balakrishnan *et al.*, 2009). A vast amount of literature shows that there exists a strong link between financial stress events in advanced economies and emerging economies where advanced economies are the driver, including between the advanced WE economies and the emerging CESEEU economies (IMF 2011; Marques, 2010; Fidrmuc, Grozea-Helmenstein, Wörgötter, 1999); some argue that trade

[5] in some cases, coming from the supranational European Union level

linkages are the primary channel of transmission (Forbes and Chinn, 2004; Forbes, 2001; Eichengreen and Rose, 1999; and Glick and Rose, 1999) while others argue that both trade linkages and financial linkages are responsible for financial stress transmission (Balakrishnan *et al.*, 2009; IMF, 2009; Kaminsky and Reinhart, 2003; Caramazza, Ricci and Salgado, 2000; Fratzscher, 2000; and Van Rijckeghem and Weder, 2000). A very recent study also argues that high levels of opacity in an emerging economy's public and private sectors increase the intensity of financial stress transmission from advanced economies to that economy (Brandao-Marques, Gelos, and Melgar, 2013). Overall, research shows that the more intertwined the financial sector of an emerging economy is to an advanced economy, the stronger the transmission of financial stress.

Beginning in the early 1990s, the rest of Europe invested heavily in the CESEEU region. Since then, WE banks have become (and remain) dominant in the CESEEU region, particularly Austrian, French, and Italian-owned banks (IMF, 2011). This fact, coupled with each CESEEU country's movement toward integration with the Economic and Monetary Union (EMU) euro area, closely intertwines WE's and CESEEU's financial sectors, strengthening the transmission of financial stress from WE to CESEEU. Research coming out of the IMF shows that there is a strong comovement in financial stress level spikes when stress originates in an advanced economy (IMF, 2009; and Balakrishnan *et al.*, 2009). On average, about 70% of stress is transmitted from advanced economies to emerging economies and is transmitted quickly (about 1 to 2 months), although individual emerging economy responses vary significantly. It is worth noting that the emerging economies

included in these studies were not exclusively from emerging Europe[6], and the countries that were included (Czech Republic, Hungary, Poland, Romania, Slovak Republic, and Slovenia) tended to fall below this mean—for example, Hungary at 10% and Poland at 50% (IMF, 2009; and Balakrishnan *et al.*, 2009).

The factors that determine the level of transmission can be grouped into two categories: common factors (across all emerging economies) and country-specific factors. Common factors can be global shocks (including changed market sentiment or shifts in risk aversion) and likely stem from increasing financial globalization—especially with FDI and portfolio investment, which has arisen as a result of the increasing presence of institutions from advanced economies in emerging markets (like WE banks in CESEEU). The major consequence of these global shocks is the blanket withdrawal of funds on the part of highly exposed financial institutions, which can spur on herd behavior in markets, cross-country contagion, and common-lender effects (Balakrishnan *et al.*, 2009; Broner, Gelos, and Reinhart 2006; Calvo 2005; and Pons-Novell 2003).

Country-specific factors include financial and trade linkages, the opacity/transparency level of domestic public and private markets, and domestic vulnerabilities stemming from structural characteristics and policies—such as current account and budget imbalances, average income-level, and connections to international sources (such as the IMF or ECB). For example, after a financial stress shock, capital-outflows initiated by investors (from advanced economies) transmit the stress to emerging economies through financial linkages, while declines in exports from emerging economies

[6] Emerging Europe consists of Central and Eastern Europe; specifically, Bulgaria, Czech Republic, Hungary, Poland, Romania, Russia, Slovak Republic, Slovenia, and Turkey. Though the majority of these are member of the EU, their economies are still yet to be considered advanced.

to advanced economies in these times of crisis transmit stress through trade linkages. When an emerging country does not disclose much information about its public and private sectors (making it opaque to an investor), this lack of transparency amplifies the intensity of financial stress transmission (Brandao-Marques, Gelos, and Melgar, 2013; Brunnermeier and Pedersen, 2009; Claessens, 2009; and Caballero and Krishnamurthy, 2008). By increasing transparency, an emerging economy can reduce herd mentality, waves of sentiment-based flows, and excessive investor reactions to news, thereby stemming capital-flow volatility resulting from financial stress transmission (Brandao-Marques, Gelos, and Melgar, 2013; Frenkel and Menkhoff, 2004; Gai, 2003; IMF 2001; and Goldstein, 1998). There is some literature, however, that posits that too much transparency would not be beneficial, because it could crowd out private information and reduce information efficiency to a point where destabilization and volatility could, again, be a problem (Morris, Shin, and Tong, 2006; Morris and Shin, 2002; and Furman, Stiglitz, Bosworth, and Radelet, 1998). However, by simply providing timely data, improving corporate disclosure standards, and improving governance, emerging economies can reach a beneficial level of transparency where financial stress shock amplification is reduced (Brandao-Marques, Gelos, and Melgar, 2013).

Country-specific vulnerabilities owing to policies and market structure also have the potential to amplify the shocks from financial stress transmission, as well as increase its rate. Solvency and liquidity problems, balance sheet weaknesses, and low levels of trade openness are all factors that increase a country's susceptibility (Eichengreen, Gupta, and Mody, 2006; Ghosh 2006; Ramakrishnan and Zalduendo 2006; Calvo 2005; Edwards 2005; Calvo, Izquierdo, and Mejia 2004; and Kaminsky and Reinhart 1999). The most critical risk

factor is having large current account deficits (IMF, 2009), and over last decade, emerging Europe has seen increasingly large current account deficits. In addition, despite that disentangling the relative importance of particular linkages (bank lending, portfolio flows, and direct investment) is rather difficult, it appears that ties in bank lending have been especially significant in the current crisis (Balakrishnan *et al.*, 2009). The fact that, by the end of 2007, emerging Europe had bank liabilities to advanced Europe at more than 50% of GDP (IMF, 2009) and that it was in emerging Europe that the most pernicious responses to the crisis were felt, lends credibility to this position. However, transmission can be buffered if, during periods of calm, a country limits external vulnerabilities and establishes a strong policy record by keeping current account and fiscal deficits low (IMF, 2009) and levels of foreign reserves high (Balakrishnan *et al.*, 2009). High levels of trade openness can also be good for buffering against financial shocks (IMF, 2009). While these are key factors for buffering an economy, they by no means can completely prevent the transmission of a financial shock. Instead, they can influence transmission to the *real* economy, as well as shorten its duration. We can see this at play when we examine the diversity of responses within the CESEEU group (and even within the WE group within the EMU) to the recent financial crisis.

The financial crisis that originated in the US in 2007 was slow to unfold in Europe until the collapse of Lehman Brothers in September 2008. This brought about the peak of the crisis, as risk aversion crippled the financial markets around the world, particularly in WE, which raised the cost of foreign borrowing for CESEE countries within the EU (CESEEU). The US Federal Reserve and the European Central Bank (ECB) quickly adopted policies meant to ease the economic tensions, but to little effect: the impact on WE banks

spilled into the CESEEU countries and quickly became a negative feedback loop, permeating the financial and real sectors of the European economies.

Not all countries, however, were equally affected, due to the heterogeneity of economic structures, policies, and conditions in each country (see above). Notably, of all the EU countries, Poland and the Czech Republic escaped relatively unscathed. This was due not only to the big pre-crisis inflows of foreign direct investment (FDI) from the WE countries in the form of economic restructuring program funds, but to the fact that both countries have high activity in the manufacturing sector and low activity in the nontradable (financial and service) sectors (this will be addressed further later in this section). Therefore, both countries were able to finance their own manufacturing sectors, as well as import and export trade without relying heavily on crisis-affected WE banks.

However, it is well known, that Greece, Ireland, Italy, Portugal, and Spain of WE and Bulgaria, Croatia, Estonia, Latvia, Lithuania, and Romania of CESEEU (only 'ESEE', actually) were the most severely affected by the crisis. Large recovery growth differentials clearly exist between these heterogeneous countries. In the case of the Baltic countries (Estonia, Latvia, and Lithuania), they took radical steps to restructure their economies and have seen improvements in export growth and domestic demand so much so that, by the second quarter of 2010, the crisis in these countries more or less abated (Aslund, 2012; IMF 2011). On the other hand, countries like Italy and Spain, which suffered higher interest costs on sovereign debt, have no ability to determine their own monetary policy adjustments due to their participation in the euro area, as members of the EMU. This meant they had to adopt the blanket monetary adjustment policies set by the European Central Bank (ECB) and integrate them with their own fiscal policies, producing a wide array of policy mixes even

across just the euro area countries. Furthermore, these countries are still experiencing prolonged effects from the recent crises.

The responses of these particular CESEEU and peripheral-euro area countries were hardly surprising, because studies had already shown that certain CESEEU countries (Czech Republic, Hungary, Poland, and EMU-member Slovenia) had already achieved levels of business cycle synchronization with the euro area higher than the EMU periphery countries (Greece, Italy, Portugal, and Spain), while the rest of the CESEEU countries lagged behind (Darvas and Szapáry, 2008; Eickmeier and Breitung, 2006; Fidrmuc and Korhonen, 2006; Traistaru, 2004; and Fidrmuc and Korhonen 2003). Therefore, the understanding of the general transmission of financial stress and an evaluation of business cycle synchronization between the WE countries of the EMU and the CESEEU countries still outside of, but working toward integration with, the EMU, and could help in the alteration of structures and policies in place in the worst-hit countries so that their economies are better buffered in the case of future scenarios of stress and crisis propagation.

2.2 Trade dynamics of the CESEEU countries

As described in the previous section, trade linkages (first and foremost, followed by financial linkages) are the main crucial channel in the transmission of financial stress and overall synchronization between the emerging CESEEU economies and the advanced WE economies. WE dominates the trade of the EU, where the EU trade to GDP ratio between 2009 and 2011 was 31.1% (WTO). With 2012 merchandise exports to the EU being 80.8%, 75.1%, 60.5%, and 58.3% of total exports in the Czech Republic, Poland, Lithuania, and

Bulgaria, respectively, [7] WE is CESEEU's premier export market—beating out Russia and Ukraine, which were the primary destinations for CESEEU-produced goods under the Warsaw Pact before these countries' transition to capitalistic economies.

An important component of the WE-CESEEU trade linkage is trade in intermediate goods for cross-border production of transportation equipment and capital goods, which accounted for about 7% of EU GDP in 2010. This linkage primarily involves Central European[8] exports to and imports from Germany, where automobiles comprise 18% of CE's exports to Germany (9% parts and components; 9% final vehicles) and 14% of Germany's exports to CE (8.4% parts and components; 5.6% final vehicles) (IMF, 2011). The fact that the growth of this intra-industry trade linkage within the widened intra-European trade is significant and came about quickly is hardly surprising, being that this has been observed before in many countries' trade after acceding to the EU (Fidrmuc, Grozea-Helmenstein, Wörgötter, 1999). Despite WE's prominence in CESEEU exports, and despite the fact that WE countries are increasingly importing more from CESEEU countries, the Asia and Pacific region still comes out ahead as WE's primary import market, with the CESEEU region just behind (IMF, 2011).

WE FDI continues to pour into the CESEEU region, robustly reinforcing trade linkages. For example, the IMF found that FDI into the tradable sector boosted both imports and exports and FDI into the nontradable (financial and services) sectors also affected trade—though only a short-term increase in imports. Interestingly, during the 2009 crisis, WE banks' funding to CESEEU fell and ended CESEEU's ability to finance imports from WE.

[7] See the WTO trade profiles: http://stat.wto.org/CountryProfile/WSDBCountryPFView.aspx?Language=E&Country=BG%2cCZ%2cLT%2cPL

[8] CE; Czech Republic and Poland

In turn, Germany's total exports, in particular, fell sharply (IMF, 2011). From this, it is quite clear that shocks to financial flows from WE to CESEEU impact trade flows, and that these financial and trade spillovers must interact.

Interestingly, regions with a specialized production structure appear to have less-correlated output fluctuations with those of other regions (Kalemli-Ozcan, Sorenson, and Yosha, 2001). This explains why Poland and the Czech Republic, both of which specialize in the production of manufactured transportation equipment and capital goods, have withstood the crisis better than their other CESEEU counterparts. However, exchange rate regimes determine how financial shocks flow into the realm of trade.

Since before the "Big Bang" accession in 2004, there have been many empirical studies on the costs and benefits of giving up exchange rate flexibility in pursuit of EMU integration that analyze the incidence and impact of real and monetary/financial shocks on the CESEEU economies (Borghijs and Kuijis, 2004; Gros and Hobza, 2003; Süppel, 2003; Dibooglu and Kutan, 2001), because the exchange rate criterion for EMU membership requires "normal fluctuation margins provided for by the exchange rate mechanism of the European Monetary System without severe tensions for at least the last two yeas before the examination."

Flexible exchange rates[9], are theoretically thought to be useful absorbers of real shocks by generating rapid adjustment to prices, but undesirable in response to monetary/financial shocks, because of upward pressure on interest rates, increasing exchange rates, and amplifying a negative shock on output. In contrast, fixed exchange

[9] such as the Czech Republic's and Poland's regimes

rates[10] theoretically neutralize monetary/financial shocks by increasing liquidity stemming from a balance of payments surplus (assuming capital mobility). Impulse-response analyses have previously supported this theory (Borghijs and Kuijs, 2004). However, in the wake of the most recent European crises, where no CESEEU country adjusted its exchange rate regime, countries with flexible exchange rates (Poland and the Czech Republic) barely saw an output contraction in the face of monetary/financial shocks while countries with pegged/fixed exchange rates saw huge output contractions (Aslund, 2012; Aslund, 2011). These outcomes lend themselves to support a reversal of roles, where output causes shifts in real exchange rates in the CESEEU countries (Süppel, 2003). This finding, then, requires a closer look at the types of shocks that affect output and trade in the CESEEU region.

2.3 Shocks: Demand and Supply

A shock to an economy is a sudden change in a variable[11] that catalyzes a flow of responses in other macroeconomic variables. Financial stress, as discussed in the first section of this chapter, can take the form of either a supply or a demand shock. The intensity and duration of these shocks depend on the level of synchronization of business cycles between countries, the strength and extent of trade and financial linkages, and the country's choice of exchange rate regime.

A supply shock is a sudden change in the aggregate supply of goods and services an economy. This type of event derives from changes in wages, productivity, capital stock, and resource prices. Changes in these variables temporarily move output down and inflation

[10] such as in Bulgaria, Estonia, Latvia, and Lithuania
[11] or variables

upward (negative shock) or output upward and inflation downward (positive shock)[12], assuming aggregate demand is unchanged. Given the rich amount of natural resources available in the CESEEU countries, their prices are determined domestically, rather than internationally. This limits the volatility in the resource price variable of aggregate supply. Studies show that, indeed, these supply shocks do not seem to follow similar patterns across the CESEEU countries nor in comparison to the WE countries (Babetskii *et al.*, 2004), indicating that they stay within the domestic economy and do not influence other economies, even those with which they have a good trade relationship.

Demand shocks, however, do follow similar patterns (Babetskii *et al.*, 2004). A demand shock is a sudden change in the aggregate demand of goods and services in an economy, which stem from changes in household expectations, personal taxes, profit expectations, and interest rates. These shocks also temporarily move output and inflation, but in the same direction—unlike the inverse-relationship of these variables in response to a supply shock. There is a high degree of symmetric[13] correlation between demand shocks in the CESEEU countries: the Baltic states[14] and the Czech Republic have highly correlated demand shocks with one another, while Hungary has significantly correlated[15] demand shocks with Poland and Slovenia (Horvath and Rátfai, 2004). Furthermore, the pattern of demand shocks seems to be specifically influenced by Germany, where the other euro area countries likewise derive influence (Karmann and Wiemann, 2004).

[12] Positive shocks are rare
[13] nearly contemporaneous with similar intensity
[14] Estonia, Latvia, and Lithuania
[15] significant at the 5% level

2.4 Monetary Policy Shock Effects on CESEEU Countries

A monetary policy shock is a special type of demand shock, which tends to act through interest rate changes and is assumed to be transitory, with no long-run effects on output and inflation. Given that monetary policy has a large potential to affect the real economy, this paper takes a particular interest in this type of demand shock, as opposed to supply shocks, which have already been the subject of a number of studies. In fact, to the current knowledge of this author, literature is sparse in this specific area of interest as it relates to the CESEEU region to the euro area (Jarocinski, 2010; and Coricelli, Balázs, and MacDonald, 2006). However, the study of the transmission of monetary policy (how fast it works and to what extent) is pertinent to the CESEEU countries, which are all obligated by their Europe Agreements to adopt the euro and join the euro area—and this requires successful inflation targeting, which requires a precise understanding of the speed and extent to which inflation is modified by interest rate instruments. In addition, it is important to determine whether the transmission of monetary policy changes operates differently in the CESEEU countries, as opposed to the WE countries, given that there is a gap in financial sector development between the regions and the fact that ECB takes a homogenous approach to policy may have sharply differing effects on the regions, posing problems for the ECP down the road.

International transmission of monetary policy changes operates primarily through the interest rate channel (the mechanism of this channel is discussed in further detail in the next two chapters, “The Euro Area and Monetary Policy” and “Theory: The Mundell-Fleming Model”). In short, this channel works as follows: short-term rates are transmitted to long-term rates, which then affect aggregate demand, then production/output. A study

evaluated the impacts of monetary policy changes in the United States on the G-6 countries[16] using VAR analysis against the Mundell-Fleming model found that interest rates are the most important facet of the transmission, as opposed to the trade-balance, suggesting that finance channels are the transmitters of monetary shocks between trade-integrated countries (Kim, 2001). A study by the ECB (Ehrmann and Fratszcher, 2006) evaluating the transmission from the United States to Europe study, also found the finance channel as the primary transmitter, and a study on the transmission from the ECB on the European countries, specifically comparing five WE countries[17] with four CESEEU countries[18], also found interest rates and the finance channel to be responsible for transmitting monetary shocks to a comparable degree in both regions (Jaroćinski, 2010). However, interruptions to this transmission can arise through individual bank decisions on how to react to changes in exogenous interest rate changes and, thus, how these exogenous changes are passed onto the real economy.

The variables with which the Mundell-Fleming model is concerned are used in the US and Europe-regional studies, above (Kim, 2001 and Jaroćinski, 2010), and it appears that the theory behind the Mundell-Fleming model does not hold up, empirically, in these countries due to the extent of their economic integration with each other. (See 'Theory: The Mundell-Fleming Model" for an explanation of the theory behind the model).

There are three main approaches to the choice of the interest rate variable in existing literature. The first is a cost of funds approach, where the market rate to retail rate transmission is the focus (De Bondt, 2002). The second approach is the monetary policy

[16] G6 countries: Canada, France, Germany, Italy, Japan, and the United Kingdom
[17] Finland, France, Italy, Portugal, and Spain
[18] Czech Republic, Hungary, Poland, Slovenia

approach, where the researchers look at the transmission of monetary policy directly to retail rates. The third approach unifies these first two by following theory a little more closely: focusing on the two-part transmission from monetary policy to market rates, and then from market rates to retail rates.

The difficulty with interest rate-to-interest rate transmission is that the yield curve, which is vitally dependent on inflation expectations and subsequent monetary policy changes, is inherently measured in the first stage when relating monetary policy and longer-term market rates. The yield curve is highly variable and country-specific so that, within a specific country, changes reveal inflation expectation or the progress of disinflation. Variability across countries arises from a lack of homogeny in views about the credibility of monetary policy or the priority given to fighting inflation versus pursuing output stabilization.

The empirical studies relating to the CESEEU region, like for other regions, mainly rely on a VAR methodology measuring exogenous interest rate shock effects within a single economy. While country coverage within the CESEEU region is unbalanced, and the quality of data may be of some concern, some general conclusions can be made about interest rate transmission in the region.

First of all, first stage transmission from monetary policy to short-term market interest rates is very high (even to the point of being complete). Secondly, the transmission from money market rates (MMRs) to short-term market interest rates is high, while its transmission to long-term market rates is unstable due to disinflationary policies altering the yield curve. These findings indicate that, in general, monetary policy transmission to

retail rates (affecting the real economy) works through short-term market interest rates and not long-term market interest rates, as theory would suggest.

Of the studies that cover the CESEEU region, an overwhelming majority focus on the second stage of the third approach—transmission from market rates to retail rates (Égert, Crespo-Cuaresma, and Reininger, 2006; and Chmielewski, 2004; Crespo-Cuaresma, Égert, and Reininger, 2004; Horváth, Krekó and Naszódi, 2004; and Sander and Keimeier, 2004). The findings in these studies show that market to retail transmission behaves similarly in both the CESEE countries and in the euro area WE countries.

The first similarity found in the CESEEU countries to euro area WE countries is that the most complete transmission is found for short-term and long-term corporate lending rates. This transmission[19] tends to be on the higher side in the Baltic countries—Lithuania, Latvia, and Estonia—and on a much lower level in the Czech Republic and in Slovakia. At the same time, there is a large range of transmission values in Poland and Hungary. In general, however, the interest rate charged on new loans is more market sensitive than that charged on old loans (except in the case of Romania).

In the case of deposit rates, transmission is less complete with short-term rates seeing a slightly higher transmission than long-term deposit rates[20]. With respect to household and corporate deposits in Poland and in Hungary, there does not seem to be any systematic difference between the transmission parameter in the long-run (Chmielewski, 2004; Horváth, Kreko and Naszódi, 2004), while transmission is slightly higher to household deposit rates than to corporate rates in Latvia and Estonia (Égert, Crespo-Cuaresma, and Reininger, 2006). Overall, it appears evident that market rate changes are

[19] measured by the β parameter of the marginal cost pricing model described in the next chapter
[20] β=0.72 versus β=0.69

not important variables when remunerating current accounts and savings accounts (Coricelli, Égert, and MacDonald, 2006).

A third similarity of the CESEEU countries to the euro area WE countries is the substantial amount of heterogeneity in long-run transmission observed even within the same market within the same country. In Lithuania, for example transmission to one-year mortgage rates is found to be complete[21] but very low[22] for five-year mortgage rates (Sander and Kleimeier, 2004).

Despite these observed similarities between the CESEEU countries and the euro area, a big difference is that asymmetric information does not play a strong role in the adjustment process in CESEEU markets (Chmielewski, 2004; Crespo-Cuaresma, Égert, and Reininger, 2004; and Sander and Keimeier, 2004). However, the datasets for these studies were limited mostly to the economic transmission period of the 1990's, due to data availability. The increasing role of asymmetric information has been observed as new data became available since these studies (Égert, Crespo-Cuaresma, and Reininger, 2006), but was still low without any clear country-specific or interest-rate-specific patterns at the time. Also observed over time is a pattern of both contemporaneous and long-run transmission increasing over time alongside a decreasing adjustment lag time (Crespo-Cuaresma, Égert, and Reininger, 2004; Horváth, Krekó, and Naszódi, 2004; and Sander and Keimeier, 2004).

In addition to studying the pathway through which monetary policy shocks flow to the real economy, researchers have also focused on discerning what factors, specifically, affect the size and speed of transmission in the CESEEU countries. They have approached

[21] $\beta=1$
[22] β close to 0

this in three ways: by estimating a time-series transmission equation by including market competition variables for banking, by estimating transmission coefficients in a time series and regress them on explanatory variables, and by investigating the reaction of the interest rate of individual banks to monetary policy steps and how they interact with bank-specific characteristics.

By pursuing the first approach, the inclusion of market competition variables yielded the result that an increase in market concentration in Poland reduces transmission for lending rates (Wróbel and Pawlowska, 2002). However, this simultaneously increases transmission for deposit rates. Therefore, because we assume that bank-lending to corporations, and even households, is the link connecting the financial and real economic sectors, market concentration slows down the transmission of monetary policy changes to the real sector.

Research taking the second approach indicates that, contrary to theory, macroeconomic variables[23] have no bearing on the size or the speed of transmission in the CESEEU countries (Sander and Kleimeier, 2004). However, a higher inflation, in this study, is associated with a stronger transmission and volatility in the money market with a weaker transmission. This finding highlights the roles of expectation and the yield curve in the interest rate channel.

The third approach to elucidating the factors that affect the size and speed of transmission focuses at the individual bank level. A study of 25 banks in Hungary found an overall heterogeneity in the key monetary policy interest rate transmission to most market and retail rates. Importantly, however, transmission is homogenous in the most important

[23] Such as financial depth or GDP

link to the real economy: corporate loans and deposit rates (Horváth *et al.*, 2004). This finding indicates that interest rates on assets connected to the real economy respond best to monetary policy changes. A study done prior to this, also focusing on Hungary, specifically examined the transmission of the money market rate (MMR) to household deposit rates at 11 banks. This study found an incomplete transmission in the long-run, but with some heterogeneity (Várhegyi, 2003). Indeed, short-term effects should be relatively strong, but may weaken over longer time horizons (De Grauwe and Costa Storti, 2005). Another study using this approach focused on Poland and found that profitable banks adjust corporate loan rates and longer-maturity deposit rates more quickly than do less profitable banks (Chmielewski, 2004). In addition, banks that are sensitive on the liabilities side of their balance sheets due to bad loans are very quick to adjust lending rates and slow to adjust deposit rates, indicating that the composition of bank portfolios is an important determinant of transmission speed. Another transmission speed determinant in Polish banks is capitalization. The better capitalized a bank, the less pressure it would feel to respond to market conditions (Chmielewski, 2004).

To summarize the findings of the studies focusing on determinants of transmission size and speed in CESEEU countries, a high concentration in the banking sector, high profitability, and high capitalization all work to mitigate transmission. On the other hand, only domestic banks were used in these studies, which offers an incomplete picture of the CESEEU economies because foreign, euro area banks are more dominant in these countries than are domestic banks. This foreign involvement has the potential to enhance interest rate transmission in these countries, especially interest rate changes originating from ECB changes to the refi rate.

3.0 THE EURO AREA AND MONETARY POLICY

The Eurozone (also called the euro area) is the monetary union within the European Union, currently consisting of 18 member states[24], where the euro is adopted as the official currency. This arrangement requires that each member state act within the framework of a common monetary policy, in lieu of domestic control over monetary policy, in order to stabilize the shared currency. The European Central Bank (ECB) determines this monetary policy framework, while individual fiscal policy remains in the control of each member.

3.1 The European Central Bank (ECB)

The ECB's primary monetary policy objective is to maintain price stability. To this end, the ECB "aims at inflation rates of below, but close to, 2% over the medium term"[25]. Inflation refers to a general increase in consumer prices at constant real values. The ECB measures inflation using an index that is harmonized across all EU member states (euro and non-euro), called the Harmonised Index of Consumer Prices (HICP). The Governing Council, the main decision-making body of the ECB, uses the HICP to define and assess price stability in

[1] As of January 2014: Austria, Belgium, Cyprus, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Latvia, Luxembourg, Malta, Netherlands, Portugal, Slovakia, Slovenia, and Spain

[25] See www.ecb.europa.eu

the euro area in order to adopt guidelines and make the necessary decisions to ensure the good performance of the euro.

The Governing Council consists of 6 Executive Board members and the governors of each of the 18 euro area national central banks (NCBs). The Council is responsible for monetary policy formulation, which includes decisions on monetary objectives, key interest rates, reserve supply in the Eurosystem[26], and establishing guidelines appropriate for the implementation of its decisions. Such evaluations and decisions are discussed in its first of two monthly meetings in Frankfurt am Main, Germany.

3.2 Overview of monetary policy framework

A set of current instruments and procedures are laid out in the "Guideline of the European Central Bank on Monetary Policy Instruments and Procedures of the Eurosystem" (as of September 20, 2011), which is essential for the uniform implementation of monetary policy decisions throughout the euro area. The Eurosystem consists of the ECB and the 18 euro area NCBs. The Eurosystem's primary objective is "to maintain price stability", as it is defined in The Treaty on the Functioning of the European Union[27] (2009), while simultaneously supporting the European Union's general economic policies. This means that an open market with free competition must be maintained in its pursuit of price stability.

[26] *Eurosystem* refers to the ECB and the 18 National Central Banks (NCBs) of the euro area; it exists within the *European System of Central Banks (ESCB)*

[27] Also known as the Lisbon Treaty

The Eurosystem utilizes three main categories of monetary policy instruments to achieve its aims: open market operations (herein OPOs), standing facilities, and minimum reserve requirements for credit institutions on accounts with the Eurosystem.

3.2.1 Standard measures: open market operations (OPOs)

OPOs are initiated by the ECB and play an important role in steering interest rates, managing the market's liquidity situation, and signaling the monetary policy stance. There are 5 instruments available for use in these operations: reverse transaction, outright transaction, issuance of ECB debt certificates, foreign exchange swaps, and collection of fixed-term deposits. A reverse transaction is an operation where the Eurosystem either buys/sells eligible assets under repurchase agreements or uses eligible assets[28] as collateral in credit operations, whereas an outright transaction is where the Eurosystem buys/sells eligible assets outright on the market. Foreign exchange swaps consist of purchasing (or selling) the euro on the spot market and simultaneously selling (or purchasing) it back on the forward market.

The reverse transaction is the most important of the OPO instruments, because it can be used in each of the four OPO categories:

> Main refinancing operations: These are regular liquidity-providing reverse transactions. These operations have a weekly frequency, with an average maturity of a week and are executed by NCBs.

28 The ECB establishes, maintains and publishes a list of eligible marketable assets

Longer-term refinancing operations: These are also liquidity-providing reverse transactions, but occur with a monthly frequency and a 3 month maturity.

Fine-tuning operations: These are performed *ad hoc* to counter liquidity imbalances from unexpected market fluctuations on interest rates accumulated since the last main refinancing operation. They manage liquidity in the market, as well as steer interest rates, and usually occur as reverse transactions, but can occur as foreign exchange swaps or the collection of fixed-term deposits.

Structural operations: These operations are carried out through the issuance of ECB debt certificates, reverse transactions, or outright transactions. They are used whenever the ECB wants to adjust the structural position of the Eurosystem vis-à-vis the financial sector. Such operations are normally executed by the NCBs, but the Governing Council can decide that they be executed by the ECB under exceptional circumstances.

3.2.2 Standard measures: standing facilities

Two types of standing facilities are available at the initiative of eligible counterparties, and are aimed at providing and absorbing overnight liquidity, bounding overnight interest rates, and signaling the general monetary policy stance. The first type is the marginal lending facility, which allows counterparties to obtain overnight liquidity from NCBs against eligible assets. The second type is the deposit facility, which allows counterparties

to make overnight deposits with NCBs. These facilities provide the ceiling and floor, respectively, of the overnight market interest rate.

3.2.3 Standard measures: minimum reserves

The minimum reserve requirement applies to all credit institutions within the euro area, and is determined for each institution in relation to elements on the balance sheet. The aim of this monetary policy instrument is to stabilize money market interest rates and to create (or enlarge) a structural liquidity shortage

Figure 3.1: Eurosystem Monetary Policy Operations

Monetary Instrument	Transaction Type		Frequency	Maturity
	Liquidity Provision	Liquidity Absorption		
Open Market Operations (OPOs)				
Main refinancing operations	reverse transactions	—	weekly	1 week
Longer-term refinancing operations	reverse transactions	—	monthly	3 months
Fine-tuning operations	reverse transactions foreign exchange swaps	reverse transactions collection of fixed-term deposits foreign exchange swaps	non-regular	non-standardized
Structural operations	reverse transactions outright purchases	issuance of ECB debt certificates outright sales	regular and non-regular non-regular	standardized/non-standardized —
Standing Facilities				
Marginal lending facility	reverse transactions	—	at discretion of counterparties	overnight
Deposit facility	—	deposits	at discretion of counterparties	overnight

3.3 ECB interest rates: the refi, euribor, and EONIA rates

The main refinancing rate (refi rate)[29] is the interest rate banks pay when they borrow from the ECB. Banks who are short on liquidity and need to borrow from the ECB must keep the refi rate (the "purchase price" of the loan) in mind when setting the interest rates they charge when lending out that money. Therefore, ECB adjustment to the refi rate has an indirect influence over interest rates on banks loans, but also on banks' interest rates on interbank transactions outside of the euro area.

The refi rate is different from the well-known Euribor (Euro Interbank Offered) rate. This rate[30] similarly influences the interest rates charged on financial products, mortgages, and savings accounts, but is the rate at which the banks within the euro area borrow from each other (*not* from the ECB). The Euribor is strongly influenced by the refi rate.

The EONIA (Euro Overnight Index Average) is the interbank interest rate on overnight loans. Due to the fact that it is not set by the ECB, like the refi is, it is sometimes called the 1-day Euribor rate.

3.4 Response to the financial crisis

In light of the intensification of the financial crisis and the associated downward risks to medium term price stability between October 2008 and May 2009, the ECB lowered the interest rate on its main refinancing operations[31]. In good economic conditions, the drop in the interest rate would be transmitted through to lending conditions for households and

[29] Also referred to as the 'minimum bid rate'

[30] Euribor is often referred to as a singular rate, but there are, in fact, 8 different rates with different maturities

[31] Herein, this interest rate will always be referred to as the refi rate

non-financial corporations through the interest rate, bank lending, balance sheet, and risk-taking channels as outlined below:

> Interest rate channel: Signals from the official interest rates would affect short-term money market rates (MMRs). Then, the change in MMRs would impact longer-maturity rates, which are the most relevant rates in private sector decision-making.
>
> Bank lending channel: Banks have access to funding (like bank capital and liquidity), which decreases pressure on the asset side of bank balance sheets and decreases the risk of sharp and abrupt contractions of the banks' loan supply.
>
> Balance sheet channel: A well-performing economy and the rise in asset prices produce a positive effect on balance sheets and borrowers' creditworthiness.
>
> Risk-taking channel: Investor perception of a positive outlook on risk-taking provides access to credit for entrepreneurial financing activity.

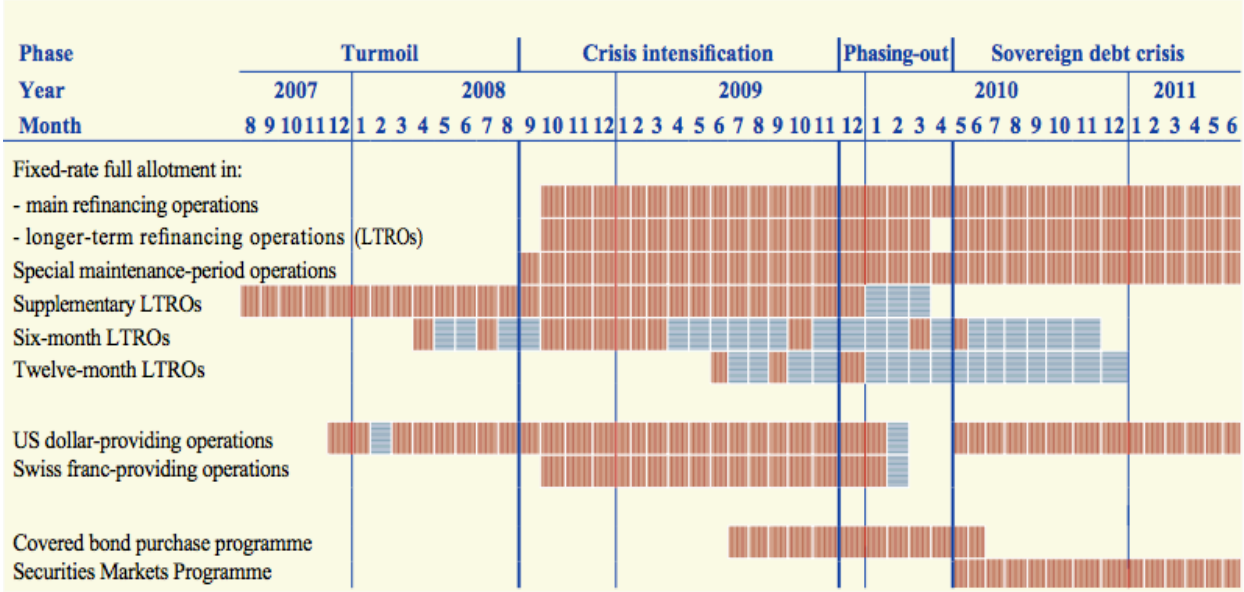
However, during the crisis, obstacles stood in the way of the ECB's monetary policy stance being transmitted through these channels. To begin with, the financial crisis impaired the transmission from the refi rate to MMRs and other bank rates, thereby halting transmission through the interest rate channel. Next, the bank lending channel was blocked by banks' difficulty in liquidating and accessing bank capital, which put pressure on the asset side of balance sheets and increased the risk of an intense contraction of the banks' supply of loans. This transmission impairment was further exacerbated by the 2010 sovereign debt crisis, where the severe disruption to liquidity in the government securities market added

extra pressure on banks' ability to loan to the private sector due to the widespread use of these securities as collateral in secured lending.

Cyclical downturn and the fall in asset prices inhibited the balance sheet channel, as well. Many borrowers, especially those who carried a lot of risk for the banks lending to them for houses, took a crushing hit to their creditworthiness. The a priori excessive risk-taking behavior came to a halt, whereby investors formed expectations of bad times and became completely unwilling to lend—this impaired access to credit for the purpose of financing entrepreneurial activity in the economy.

The ECB addressed these obstacles, which were rendering markets dysfunctional and could have spread the contagion, by introducing non-standard monetary policy instruments to complement, and make more effective, its monetary policy stance. These measures were temporary, and were introduced and phased-out as needed. The non-standard measures that were used include the fixed-rate full allotment in main refinancing operations and longer-term refinancing operations (LTROs), special maintenance-period operations, supplementary LTROs, six-month LTROs, twelve-month LTROs, US dollar-providing operations, Swiss franc-providing operations, a covered bond purchase program, and a securities market program. Most of these instruments only required changes in the parameters of existing operations in the ECB's monetary policy framework, and the flexibility retained in making policy adjustments in response to further economic and financial developments helped ensure the Eurosystem's objective of maintaining price stability. The introduction and phasing-out of each of these instruments between August 2007 and June 2011 is summarized in Figure 3.2.

Figure 3.2: Chronology of ECB's non-Standard Measures from August 2007 to June 2011



Source: ECB.
Notes: The reddish brown bars indicate that operations were conducted in the specific month, while the petrol blue bars indicate that no new operations were conducted but that the liquidity provided in previous operations remained in place. The chart covers the main measures discussed in the text, but does not cover all of them as some are not easy to include, e.g. decisions related to collateral and to fine-tuning operations. Special maintenance-period operations are ECB refinancing operations with a maturity matching the length of the reserve maintenance period.

Copyright: European Central Bank[32]

3.5 The ECB's non-standard measures

The ECB introduced money market-based and securities market-based measures to provide a flexible response to the crisis. These measures were designed to complement existing standard measures and, in conjunction to measures introduced by euro area governments for their banks, ultimately prevented a disorderly deleveraging process[33].

The first non-standard measures introduced were money market-based, which was the market whose malfunction was the primary impairment in the first phase of the financial crisis. The supplementary LTROs were introduced as the first non-standard

[32] Taken from the July 2011 ECB Monthly Bulletin, which is available online free of charge
[33] See July 2011 ECB Monthly Bulletin, "The ECB's Non-Standard Measures- Impact and Phasing Out"

measure[34], in response to banks' uncertainty of their liquidity positions influencing them to frontload their liquidity. These supplementary LTROs provided larger allotment amounts in main refinancing operations, and banks' access to these during that period reduced volatility in short-term interest rates and helped maintain a good operational framework, in which overnight interest rates could be steered toward the Refi rate.

The next step began in December 2007, after the US Federal Reserve's Open Market Committee (FOMC) authorized dollar liquidity swaps with the ECB[35]. This allowed the ECB to begin US dollar liquidity operations against ECB eligible collateral and swaps. These operations also countered foreign-currency funding difficulties experienced by some internationally active banks. Almost a year later, in October 2008, the ECB also provided these operations using the Swiss franc.

In the second week of October 2008, during the intensification (phase 2) of the crisis, the ECB reacted to the exacerbated money market tensions by introducing fixed-rate tenders (with a full allotment of the liquidity demanded by counterparties) in place of variable rate tenders. In addition, the ECB also extended the list of eligible collateral by adjusting the quality thresholds for particular asset classes, which enabled banks to take advantage of these new fixed rate full-allotment tenders.

Another way to provide banks with certainty of funding sources was to lengthen the maturity of LTROs to 12 months. These LTROs helped stabilize money market spreads at levels below those prior to phase 1 of the crisis by allowing the bank system to better plan and strategize activities, and to maintain lending to households and non-financial corporations.

[34] Supplementary LTROs were introduced in August 2007
[35] These swap lines were unlimited for the ECB

While some of the temporary LTROs that were introduced in the early stages of the crisis were beginning to be phased out, the ECB began concentrating on the securities market. In consideration of the fact that the issuance of covered bonds is a primary source of financing for euro area banks, the ECB introduced its Covered Bond Purchase Program (CBPP) on May 7, 2009, in which the Eurosystem purchased outright €60 billion worth of euro-denominated covered bonds[36]. The objective of this program was to improve liquidity and ease credit conditions in the bonds market.

In the last two months of the 12-month operation of the CBPP, the sovereign debt crisis hit, which called for another securities-market based program to improve the operation of the monetary policy transmission mechanism in this market. The Securities Market Program (SMP) was introduced in May 2010 as a way for the Eurosystem to re-absorb liquidity from the bond purchases done through the CBPP. The SMP made both public and private debt securities available for purchase.

[36] Only those that were issued within the euro area

4.0 THEORY: The Mundell-Fleming Model

This chapter begins with an explanation of the Mundell-Fleming model, which is the traditional theory used to describe how the monetary transmission mechanism (MTM) works within, and between, countries. The second section of this chapter considers an extension to the Mundell-Fleming model, which focuses on a two-stage transmission pathway once a monetary shock is introduced into the financial sector of an economy.

4.1 Theory of how the Monetary Transmission Mechanism (MTM) works: the Mundell-Fleming IS-LM-BB model

The traditional theoretical explanation is the Mundell-Fleming, or open economy IS-LM-BB model. This model describes shock effects on interest rates, output, trade balance, and the exchange rate (including from international components affecting the goods and assets markets) by illustrating shifts in the consumption (IS), liquidity-preference money supply (LM), and the balance of payments (BB) curves. The traditional open-economy Mundell-Fleming model has also been enhanced by a two-stage interest rate transmission channel, through which monetary policy shocks are thought to be transferred to the economy.

Given that CESEEU is still considered a developing region, we can assume the situation of imperfect capital mobility. What this entails is that the foreign interest rate (set

by the ECB for the euro area), trade flows, and the exchange rate level all play a role in shifting the BB curve by changing levels in the current account and financial account balances. The relationships between the variables are described in the following equations:

$$\mathbf{OB=CAB + FAB} \quad (4.1)$$

Where OB is the overall balance, CAB is the current account balance, and FAB is the financial account balance.

$$\mathbf{CAB=X-M= X_0 + \chi E - IM_0 + \mu E - mY} \quad (4.2)$$

Where X_0 is the initial level of autonomous exports, χ is the sensitivity of foreign spending on the country's domestic exports as the exchange rate level changes, E is the exchange rate level, IM_0 is the initial level of autonomous imports, μ is the sensitivity of import spending in the country to exchange rate level changes, m is the marginal propensity to import, and Y is output.

$$\mathbf{FAB=q(i - i^*)} \quad (4.3)$$

Where q is the degree of international capital mobility, i is the domestic interest rate, and i* is the foreign interest rate.

Therefore, the BB curve results when we substitute the CAB and FAB equations into in the OB equation and solve for i, such that:

$$\mathbf{BB\ curve:\ i= (IM_0+X_0)/q + (m/q)Y - ((\chi+\mu)/q)\ E + i^*} \quad (4.4)$$

Notice that the slope of the BB curve is dependent on the degree of international capital mobility, so each CESEEU country's level of integration with the euro area is an important determinant of the degree of transmission of the ECB interest rate into the domestic economy.

Before describing the behavior if the BB curve to changes in the goods and money markets under different exchange rate regimes, let's look at the goods market and assets market individually (these are described by the IS and LM curves, respectively). In the goods market, the IS curve is the equilibrium where desired investment plus the CAB equals desired savings (this is equivalent to where demand equals supply). The condition for this equilibrium is described as:

IS curve: Y= C+I+G+CAB (4.5)

Where C is domestic consumption, I is domestic investment, G is government spending, and CAB is the current account balance (as defined by 2.2).

Some of the variables on the right-hand side of the IS curve equilibrium condition can be further decomposed to reveal other factors at play in the goods market:

$C= C_0 + c(Y-T) - fi$, and $0<c<1$; $0<f$ (4.6)

This is the consumption function, where C_0 is the amount consumers are always willing to spend on goods and services, c is the marginal propensity to consume, Y is income, T is taxes, f is the sensitivity of consumption to interest rate changes, and i is the domestic interest rate.

$I= I_0 - bi,$ and $0<b$ (4.7)

This is the desired investment function, where I_0 is the amount investors are always willing to invest, b is the sensitivity of investment to interest rate changes, and i is the domestic interest rate.

Substituting (4.2), (4.6) and (4.7) into (4.5), the IS curve equilibrium can be written as:

$Y= \alpha\{A_0 - (f+b)\, i+ (\chi+\mu)E\}$ (4.8)

Where A_0 is a simple stand-in for $C_0 - cT_0 + I_0 + G_0 + X_0 - IM_0$ and α is $1/(1\text{-}c\text{-}m)$.

Written this way, it is easy to see that the exchange rate is an important variable whose movements affect the IS curve.

In the assets market, the LM curve is the equilibrium where the domestic supply of money equals the demand for money, L, which is a function of interest rates and income. Mathematically:

LM curve: M/P= L(i,Y) (4.9)

Like we did for the IS curve, the LM curve can be further decomposed to reveal more underlying factors. The demand for money, L, is a function of income and interest rates, such that:

L= kY – hi, both k and h are >0 (4.10)

Where k is the sensitivity of demand for real money balances to changes in income, Y is income, h is the sensitivity of real money demand to changes in the interest rate, and i, again, is the interest rate.

In this model, the overall balance in the long-run is where the IS, LM, and BB curves all intersect.

Now, let us introduce exchange rate regimes to the model. In countries with flexible exchange rates[37], the overall balance of payments must sum to zero in order to reach equilibrium. It is thought that the automatic adjustment of exchange rates to a new equilibrium acts as an absorber of goods market shocks, so that a fall in demand for domestic exports leads to a currency depreciation. However, complete insulation from shocks under a perfectly balanced balance of payments is only possible in a closed

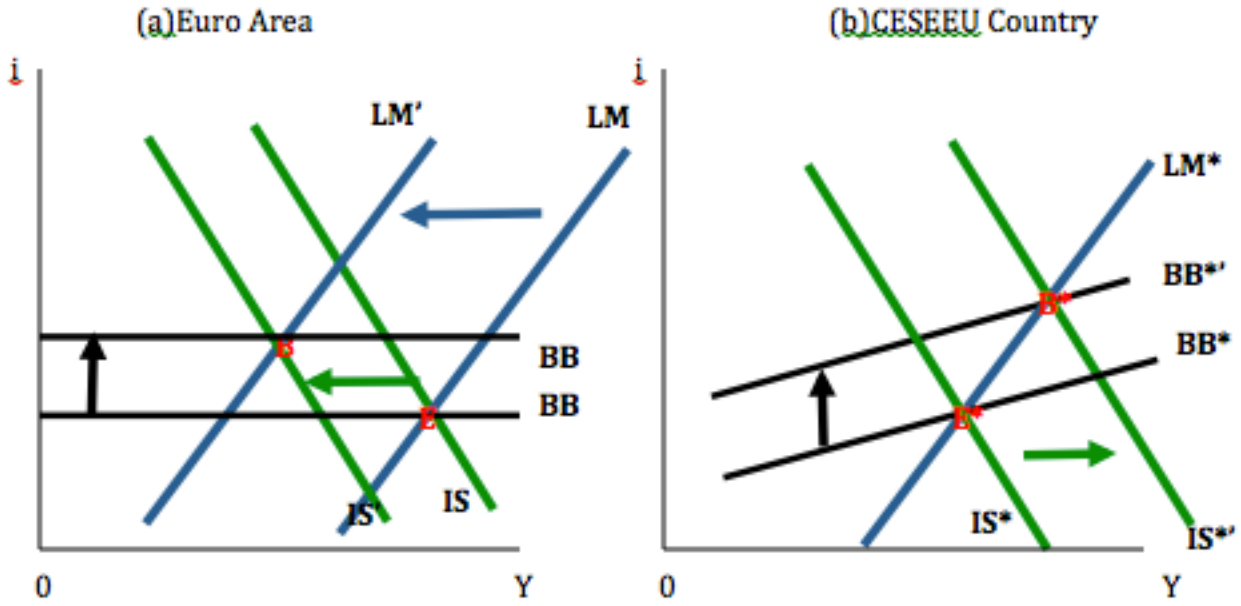
[37] Czech Republic and Poland both have flexible exchange rates

economy with no trade. In reality, complete insulation does not happen, for countries are increasingly linked via trade and financial sectors. There are, in fact, two pathways through which disturbances could pervade the insulation provided by flexible exchange rates: 1) capital flows that usher international transmission through trade flows, and 2) effects stemming from exchange rate changes other than those originating from the trade balance.

Even in the presence of an overall sum of zero for trade balance plus the capital account, if there exists any degree of capital flow, the trade balance, itself, cannot be zero. This is because this capital flow is financing a trade deficit in one country from a trade surplus in another. In the case of a monetary contraction in one country,[38] the LM curve would shift out to the left in that country. The resulting higher interest rate in Country 1 from this contraction would then induce capital inflow, thereby appreciating the country's currency and shifting the IS curve out to the left. Meanwhile, the other country's currency depreciates and its IS curve moves rightward. Under perfect capital mobility[39], which is the case in the most industrialized countries of the world, this appreciation/depreciation and the resulting IS curve shifts continue until interest rates in both countries are equal. However, emerging economies, such as those in the CESEEU region, do not have perfect capital mobility—this means the BB curve, which curves upward, will shift to the right. Therefore, the respective IS curves will shift until the country's LM, BB, and IS curves intersect in the country's own equilibrium, and, because these shifts are country-specific and depend on the sizes of α, χ, and μ, there is no guarantee that interest rates will always align. This scenario is illustrated below in Figure 4.1, where the euro area is Country 1 and a CESEEU country is Country 2.

[38] or region
[39] illustrated by a horizontal BB curve

Figure 4.1: Monetary Contraction in a Two-Country Mundell-Fleming Model with a Flexible Exchange Rate Regime in Country 2



The second transmission pathway happens via exchange rate effects that exist in addition its effect on the trade balance. These effects do not depend on the existence of capital flows. An increase in the exchange rate between the two currencies—euro/złoty in the case between the euro area and Poland—would increase the złoty prices of imports from the euro area. For there to be an effect on Polish output, however, there needs to be an additional effect on savings, money demand, prices of imported inputs, or wages—which all can originate from the higher import prices in złoty.

Within countries with fixed exchange rates,[40] the exchange rate cannot shift as a result of shocks, because it is set by the government, not the market. Therefore, these

[40] such as Bulgaria and Lithuania

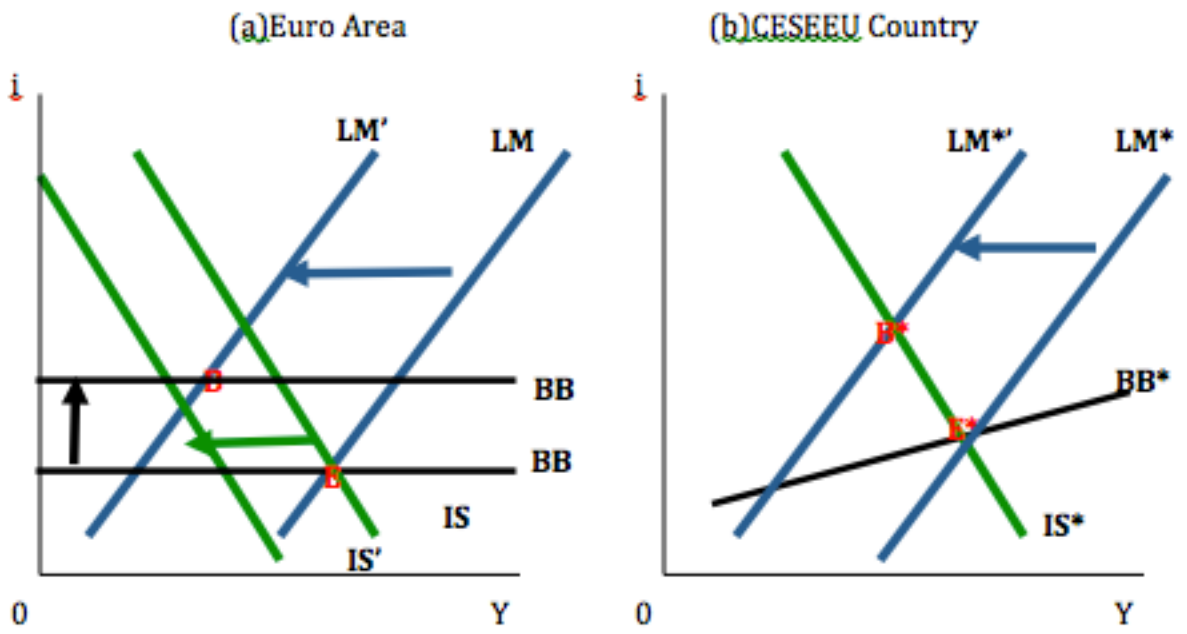
countries would experience a different set of effects from a shock than those countries with flexible exchange rates.

Under the assumption of imperfect capital mobility for the emerging CESEEU economies, the balance of payments BB curve becomes an even more important element under fixed exchange rate regimes because, in order to keep the exchange rate from shifting, the government must use foreign reserves to buy or sell its own currency. In conducting domestic monetary policy in response to exogenous monetary contraction shocks, the country's central bank adjusts its holdings of domestic credit and international reserves by conducting open market operations[41] in an attempt to decrease its own money supply. Therefore, the decrease in the money supply shifts the LM curve to the left, raising the interest rate, which mitigates spending and lowers income. This induces capital outflow and puts the overall balance of payments in deficit.[42] Traders then buy foreign currency with domestic currency—this puts pressure on exchange rates, so the central bank sells its international reserves. This cycle cannot continue indefinitely, so domestic monetary policy will have to eventually adjust. This adjustment can be a deliberate reversal of the monetary expansion, automatic adjustment of the money supply through the balance of payments deficit, or an adjustment to the exchange rate itself.

This sensitivity to foreign shocks is predicated on the degree of foreign involvement in that country's economy. In the case of the CESEEU countries, each are integrated with the countries of the euro area to a high (albeit, heterogeneous) degree in finance and

[41] buying or selling government bonds
[42] Note that, under fixed exchange rate regimes, the balance of payments is not assumed to be 0, as in the case of flexible exchange rates.

Figure 4.2: Monetary Contraction in a Two-Country Mundell-Fleming Model with a Fixed Exchange Rate Regime in Country 2



trade—but also through policy, as they continue to attempt to create conditions in their domestic economy similar to those in the euro area WE countries. Therefore, we can assume that when the ECB lowers its refi interest rate, which signals to the euro area banks to adjust their market and retail interest rates, this monetary policy shock will affect the CESEEU countries by influencing the WE economies as described by the IS-LM-BB model, which will spillover to the CESEEU economies through trade and finance flows, and by influencing the WE banks in the CESEEU countries, which create conditions for the CESEEU economy to absorb the ECB policy change through the financial sector.

4.2 A two-stage transmission pathway: An extension of the Mundell-Fleming model

Now that we understand generally how the Mundell-Fleming IS-LM-BB model operates, we can focus on the interest rate channel it is thought to encapsulate (Coricelli, Égert, and MacDonald, 2006) and how it works to transmit shocks by going through the financial sector. Within a single economy, this channel has two stages.[43] The first stage encompasses the transmission from short-term nominal interest rates to long-term real interest rates. If this transmission is successful, then shifts in the IS, LM, and BB curves would stay put. The factors affecting this stage of transmission are liquidity preference, market segmentation, and expectations—all, primarily, concerning the LM curve.

Generally, investors require a liquidity premium for holding assets with long-term maturities, because these are less liquid than other assets. This will affect how banks choose to adjust their long-term interest rates. Also, many different markets exist within one economy, so the determination of short- and long-term interest rates within one market is independent of the determination in other markets—making transmission heterogeneous even within one economy. Finally, expectations are key, because they determine the shape of the yield curve. In this view, the long-term interest rates are predicted based on the averages of expected future short-term interest rates, which in turn are tied to the short-term euro area interest rates in the case of CESEEU countries.

Once the first stage is successfully transmits the monetary policy shocks from the euro area to the CESEEU countries through short-term nominal rates, and then from the

[43] Here, we are starting from the point of impact of the ECB interest rate changes on market and retail interest rates of WE or CESEEU banks. We are assessing how the monetary policy change is transmitted to real long-term interest rates through nominal short-term interest rates, because changes in the long-term rates induce a real change shift in the IS-LM-BB model, unlike the short-term nominal rates, which could quickly move back to the initial point of equilibrium.

short-term nominal rates to real long-term rates, the second stage begins. This stage concerns the transmission of changes in the real long-term interest rate to the real economy (such as aggregate demand, production, and trade). Because a major link between the financial sector and the real economy is through saving deposits and loans, the market rate-bank lending link is an important facet of transmission in this second stage. This link will vary from bank to bank, depending on how quickly or how aggressively each banks chooses to act in response to long-term market interest rate innovations. Their choice in the interest rate, which can also be thought of as the price they charge on an asset, can be illustrated by the marginal cost pricing model:

$$\mathbf{i^B = \rho + \beta (i^M)} \qquad \text{and } 0<\beta<1 \qquad (4.11)$$

Where i^B is the price set by the bank, ρ is the constant mark-up, β is the transmission parameter of the market interest rate, and i^M is the market interest rate.

In perfect competition and complete information, the transmission parameter, β, is equal to one, while a number less than one reflects imperfect competition and asymmetric information. The degree of this parameter depends on the interest rate elasticity of demand for loans and deposits. Incomplete transmission (where $\beta<1$) exists if there is imperfect substitution between bank deposits and other equal-maturity/flexibility investment facilities, imperfect substitution between deposits and other types of external finance (like bond markets), it is costly to change banks (switching costs), or if switching costs combined with a high banking sector concentration creates market segmentation leading to a monopolistic market structure scenario (so that banks will determine their own interest rates on their own time and by their own choice).

It is thought that when long-term interest rates in the assets market are rising, banks adjust lending interest rates more quickly than they do deposit interest rates; and when long-term interest rates in the assets market are falling, banks decrease deposit rates more quickly than lending rates (Weth, 2002; Hannan and Berger, 1991). However, the speed and aggressiveness of their adjustments in response to market rates can be influenced by many different factors[44]. For instance, in the presence of adjustment costs, banks respond more slowly and may even choose to move their rates less frequently, but more substantially. The bank's portfolios also play an instrumental role: if they have the majority of long-term loans covered by long-term deposits, they feel little pressure to adjust their lending rate, because their liabilities are covered. Additionally, if banks have good, long-term relationships with their customers, they may try to iron out interest rate changes to keep the customers happy.

Finally, macroeconomic conditions still hold sway in the speed of transmission from long-term interest rates to the real economy. Both increasing economic growth and increasingly high inflation tend to speed up transmission. Conversely, increasing economic uncertainty (which can appear as increasing interest rate volatility) can slow down transmission as banks postpone adjustment responses until they can get a better idea of what is happening in the economy.

[44] This could very well be the key juncture in determining the rate and degree of the monetary policy transmission, overall.

5.0 RESULTS AND DISCUSSION

This chapter begins with a layout of the variables and the methodological setup. Next, an overview of the general results found for the CESEEU region is presented, followed by the presentation and discussion of the results for each country in the sample (Bulgaria, the Czech Republic, Lithuania, and Poland).

5.1 Vector Autoregression (VAR) Analysis

Vector autoregression (VAR) is a type of econometric, multivariate time-series analysis, where all variables are treated symmetrically. In this way, the current and past values of each variable can affect the time path sequence of all the other variables, creating feedback loops among the variables as each time series evolves. This type of modeling captures the interdependencies of the dynamic variables without requiring an exact knowledge of how the included variables interact—only that they should hypothetically affect each other.

Introduced in 1980 by Sims, VARs can provide a coherent approach to elucidating the interactions between variables in a linear time-series, which can be credibly used for forecasting, structural inferencing, and policy analysis. Depending on the use for which a VAR is intended, its properties are determined using impulse response, Granger causality,

of forecast-error variance decompositions. This thesis seeks to measure the change in macroeconomic variables in the CESEEU countries in response to a change in ECB monetary policy. Therefore, the impulse response function is used.

The impulse response function gives the predicted reaction of the variables within the VAR, as a function of time, when presented with a brief shock, or impulse. In order to recover the responses, an identification restriction must be imposed on the system. For example, the contemporaneous value of a variable can be constrained such that it does not have contemporaneous effects on all the other variables. This type of identification restriction is called Choleski decomposition. Choleski decomposition forces an asymmetry on the system by imposing an ordering of the sequence in which the variables are affected by the shock. In other words, it specifies a variable that is directly affected by the shock, and the other variables are only indirectly affected by the shock after the first variable responds. Therefore, the researcher must have some a priori knowledge as guidance in determining the ordering of the variables.

5.2 Variables

The goal of this thesis is to analyze the transmission of shocks to the monetary policy via the ECB interest rate of the WE euro area countries into the merchandise exports of non-euro area CESEEU countries in the east of the EU.

The WE euro area countries were obligated to meet the convergence criteria, as laid out in the 1993 Maastricht Treaty, in order to adopt the euro and become part of the euro area. This means that each country must maintain a domestic long-term interest rate of no

more than 2% higher than the unweighted average of the three best performing[45] euro area members (Treaty on the European Union, 1992). Whenever the ECB changes its interest rates, the WE countries respond by adjusting their domestic interest rates, which will affect funding and economic transaction decisions—and these will be transmitted into the CESEEU countries via their reliance on WE countries' banks. Therefore, the exogenous monetary policy shock in this study can be empirically measured by the change in the ECB interest rate.

The best ECB interest rate to use, in this case, is the main refinancing (refi) rate. As discussed in section (3.3) of chapter 3, the refi rate is the interest rate banks pay when they borrow from the ECB and, therefore, is factored into the interest rates they charge on loans to businesses, consumers, on mortgages, and on savings accounts. It also indirectly influences WE banks' interest rates on transactions with the CESEEU banks outside of the euro area. Therefore, a change in the refi rate will manifest as a monetary policy shock and be transmitted through the WE countries to the CESEU countries. Data on ECB refi rate changes are taken from ECB's online database, and smoothed out into three-month moving averages.

Given that it is the top importer of CESEEU country's exports[46], Germany is chosen as the WE country representative in this study. Germany has long been recognized as the most influential of the EU economies on the CESEEU region, owing to its proximity and its economic size. Furthermore, out of all the WE countries, Germany also displays the

[45] in terms of price stability

[46] Germany is the primary trading partner for the majority of CESEEU countries—but if it is not number 1, it is always in the top 5.

strongest responses to monetary policy changes the ECB undertakes. Therefore, Germany should be the best transmitter of ECB changes into the CESEEU economies.

To represent the heterogeneity of the CESEEU region, two Visegrad[47] countries, one Baltic country, and one Southeastern European country were chosen. The Czech Republic and Poland are included in the sample as the two Visegrad countries. These two Central European countries are the closest trade-integrated countries with the Germany and the rest of the western EU countries out of the entire CESEE region. Lithuania is included as the Baltic/East European representative country because it is not on the euro[48] and it is closer to some WE countries, especially Germany, via the Baltic Sea than is Latvia. Bulgaria is the representative of Southeastern Europe in this study. This choice was made due to the availability of reliable data[49] and its overall representation of Southeastern Europe as a whole. Estonia, Slovakia, and Slovenia are already in the euro area, so they are automatically excluded from the CESEEU group.

While the refi rate is the exogenous, monetary policy variable, the remaining variables in the empirical setup are modeled off of the Mundell-Fleming IS-LM-BB model. These include the endogenous variables are CESEEU money market interest rates, CESEEU real effective exchange rates,[50] CESEEU volume of exports, and German volume of exports.[51]

[47] Visegrad is used synonymously with Central Europe
[48] Estonia adopted the euro in 2011
[49] All data for Croatia was not available at the time of conducting this research
[50] indexed on CPI
[51] Data taken from the International Financial Statistic (IFS) and Eurostat databases

5.3 A brief description of the methodological set-up

The beginning of the time period under analysis is concurrent with the introduction of the euro, and goes through to the most recent available quarterly data: 1999:Q1 to 2012:Q4. Each country pairing (Germany with each CESEEU country) will be analyzed over this period using a vector autoregressive (VAR) impulse-response model.

A VAR model, as put forth by Sims (1980), is used because it has been proven to be incredibly successful in describing the dynamic behavior of economic and financial time series. The Regression Analysis of Time-Series (RATS) software was used to measure the impact a shock to the refi rate would have on each CESEEU variable in the sample. Each VAR was done using a Choleski orthogonalization, setting the ordering of the variables as follows: Refi rate, CESEEU country's money market interest rate, CESEEU country's exchange rate, CESEEU country's volume of exports, and Germany's volume of exports. Similar VARs were also run using GDP data.[52] Prior to running each regression, the optimal lag length was tested using both the Akaike Information Criterion (AIC) and Schwartz Bayesian Criterion (SBC) tests, which generally agreed.

[52] CESEEU country GDP was used to run two more regressions. In one, this variable replaced German export volumes. In the other set, the CESEEU country GDP replaced that country's exports, while keeping the German export variable. The results of these regressions only showed that the variations in exports account for the GDP variations so that when GDP is used instead of exports, very similar results to those reported in this chapter were observed. Therefore, discussion of these results is not included in this chapter.

5.4 Overview of results

In general, the results of the CESEEU countries display similar patterns in the movement of variables to the counterpart variables in the euro area, specifically trending around the German business cycle. Out of this sample of countries, the two Visegrad countries—the Czech Republic and Poland—display the highest synchronization with Germany and the euro area, which is evidenced by the similar shape, intensity, and time of transmission of their interest rate and export impulse response curves to the curves for the euro area refi rate and Germany's exports. In fact, the interest rate in the Czech Republic rises contemporaneously and to almost the same degree with the rise in the refi rate from the positive shock during the first period. Interest rates in Bulgaria, however, exhibit the strongest reaction to the euro area contractionary monetary policy shock in the short run before leveling out with the refi rate in the long run, beginning at the eleventh period. The response of interest rates in Lithuania, on the other hand, is hesitant and weak in the short run, before responding after the second period.

Predictably in the Czech Republic and Poland, exports initially decrease contemporaneously with an initial increase in German exports, indicating a very fast transmission time—or at least one equal to the time it takes for an ECB monetary shock to be transmitted to German exports. This would be due to the fact that both countries have the closest and most integrated economic relations with Germany out of the CESEEU countries. Lithuania and Bulgaria, on the other hand, have smaller export sectors, so even though Germany is among their top trade partners for both countries, each country

displays a slower transmission time—it takes 24 and 16 periods in Bulgaria[53] and Lithuania, respectively, for the shock in the refi rate's influence on exports to peak. Bulgarian exports also seem to move in the same direction as Germany's, rather than in the opposite direction that would indicate normal two-country trade relations, which further supports that the transmission of the monetary policy shock happens through the finance, rather than trade, channel before affecting the export sector.

Transmission intensity is also heterogeneous among these sample countries, especially given that the transmission channels are not all the same, but the median intensity of the transmission, as interpreted by variance due to the variable with which the export sector interacts most directly, is 36%.

It is important to point out that both Bulgaria and Lithuania maintain fixed exchange rates against the euro. However, the assumption in the model that exchange rates can be changed is still applicable to either country, because the real effective exchange rate can still change since it is a weighted average of exchange rates with many trading partners. Therefore, the results depict the pressure that is put on the exchange rate, which would call for intervention from the domestic central bank by either deliberately imposing a domestic monetary expansion or by adjusting the supply of domestic currency through the balance of payments surplus.

Uncertainty bands for each variable in the CESEEU countries are wider than for the uncertainty bands for the response of German exports, and these include the possibility for even stronger or weaker monetary policy effects in the CESEEU countries than in the core euro area, as proxied by Germany. This is in line with the findings in a previous study done

[53] Period 24 is the last period covered in the sample, so it is possible that it takes even longer for the refi rate to be fully transmitted to the Bulgarian export sector before its effect begins to decline

by Jarocinski (2010), but the results of this present study indicate a narrowing of these bands.

It should also be noted that the choice to use the refi rate as the monetary policy instrument responsible for transmission in the both the euro area and the CESEEU region appears to be sound; it is the only variable that accounts for 100% of its own impulse response variance at its own initial shock, and continues to account for the majority of its own variance through to the end of the time sample.

5.5 Bulgaria

The results for Bulgaria appear to be in line with what the Mundell-Fleming IS-LM-BB model would predict for a country with a fixed exchange rate in response to a euro area monetary contraction[54]: interest rates are decreased, exports rise, and pressure is put on the exchange rate. However, the refi rate variable better accounts for variance in Bulgarian interest rates than for Bulgarian exports throughout the entire time span—accounting for about 45% of interest rate variance, as opposed to about 9% variance in exports. However, none of the variables in the regression seem to explain the variance in Bulgarian exports very well. This suggests that transmission is propagated through finance channels, not through trade channels, despite leaning toward a trade-oriented economy.

This finance channel transmission makes sense in Bulgaria—despite that its financial sector, along with Romania's and the three Baltic countries'[55], remains the most underdeveloped of all the current EU countries—because of the dominance of euro area

[54] Contractionary monetary policy is the positive shock to the refi rate
[55] Baltic countries: Estonia, Latvia, and Lithuania

banks and financial institutions in the country. Any ECB change would be reflected in a change in the euro area countries, no matter where their banks are located. The Bulgaria-based banks would then influence the Bulgarian domestic rates.

As a small, open economy, its dependence on a WE-dominated finance sector and on a relatively volatile trade sector makes it vulnerable to exogenous demand shocks.[56] As noted in section 5.3, Bulgaria displays the most intense short-run response in exports to shocks of all the countries in this CESEEU sample. However, it also exhibits the widest uncertainty bands, which suggests that the interrelationships between the variables in the VAR are relatively weak. Given the weak interrelationships, a wide range of responses to a shock cannot be ruled out.

In 2008, Bulgaria fell into a current account crisis, displaying one of the biggest current account deficits in the EU (Aslund, 2012). This deficit resulted from years of monetary policy expansion[57] in both the euro area and in Bulgaria; Bulgaria's currency—which is pegged to the euro—was depreciating and that Bulgaria was importing far more than in was exporting. With inflation in the double digits and a big current account deficit, Bulgaria faced heavy pressure in maintaining the value of its currency against the euro. As discussed in section 4.1, a country with a fixed exchange rate regime facing exchange rate pressure has three choices: 1) reverse the monetary expansion and institute monetary contraction; 2) adjust the money supply through the balance of payments deficit; or 3) adjust the exchange rate itself. The first option does not make sense in the midst of a crisis, because the initial point of the crisis already plunges the economy into unwanted

[56] Remember, a monetary policy shock is a type of aggregate demand shock

[57] Note that the policy shock in this study is positive, meaning a policy contraction. Therefore, the direction of the results of this study can be reversed and applied to the expansionary case

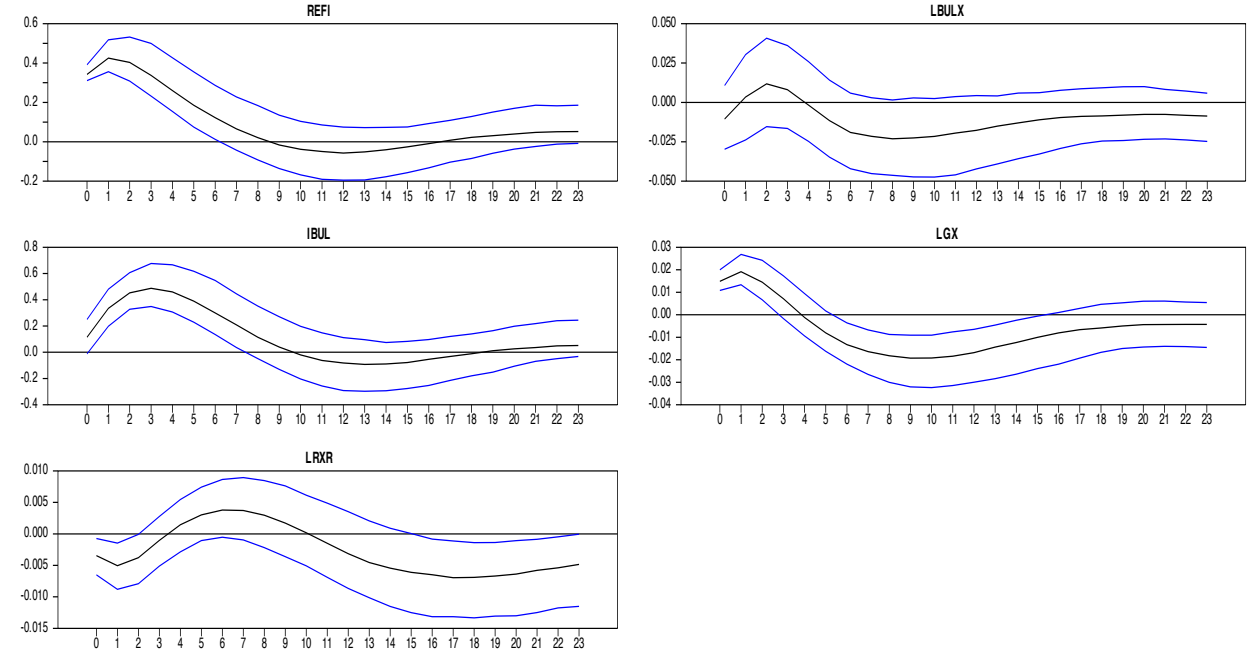
contraction. The third choice is generally not a good one due to costs associated with adjusting a fixed exchange rate. Therefore, the best choice is to somehow adjust the money supply through the balance of payments, and Bulgaria did this by pursuing radical adjustments through internal devaluation to render their export sector more competitive.[58]

The fiscal adjustments that Bulgaria pursued in response to the crisis included boosting the collection of VAT taxes, eliminating public subsidies for the railway system, and reforming pensions by raising the retirement age and tightening pensions paid to military and police personnel. Bulgaria also received EU funds with the purpose of increasing the Bulgarian government's spending on infrastructure and active labor market policies, so that Bulgaria could see stable and sustained economic growth. As a result of all of its adjustments, Bulgaria was able to balance its balance of payments by becoming trade competitive, turning its deficit into a surplus and boosting exports by 42% (Aslund, 2012).

The structure of Bulgaria's economy makes it particularly susceptible to shock transmission from WE and the euro area, as evidenced in the results of this study, by its recent experience in the 2008 world crisis, and by the observation that it is currently teetering on another recession. Domestic fiscal policies[59], therefore, must be geared toward mitigating trading sector volatility, as they were able to do with mild success in the face of the 2008 crisis.

[58] In pursuit of internal devaluation in the face of its 2008 CA crisis, Bulgaria cut wages and public expenditures, which made cost levels more competitive and turned the CA deficit into a CA surplus.
[59] Fiscal policies, as opposed to monetary, given the limited influence its domestic monetary policy has in its fixed exchange rate regime economy.

Figure 5.1: Impulse-responses in Bulgaria to shocks in the ECB refi rate



5.6 Czech Republic

The Mundell-Fleming model for a flexible exchange rate regime predicts that a positive shock to the refi rate would cause a rise in the Czech Republic's interest rates, followed by depreciation in the exchange rate. The results in this study support this model for the Czech Republic. Indeed, in the short run, Czech interest rates rise—with a lagged response of about one period to the refi rate shock—and this rise in the interest rates influences the depreciation of the exchange rate. However, at six periods, the interest rate and exchange rate begin a different relationship, where interest rates fall, but the exchange rate continues to appreciate. Therefore, the Mundell-Fleming framework falls apart, as has been

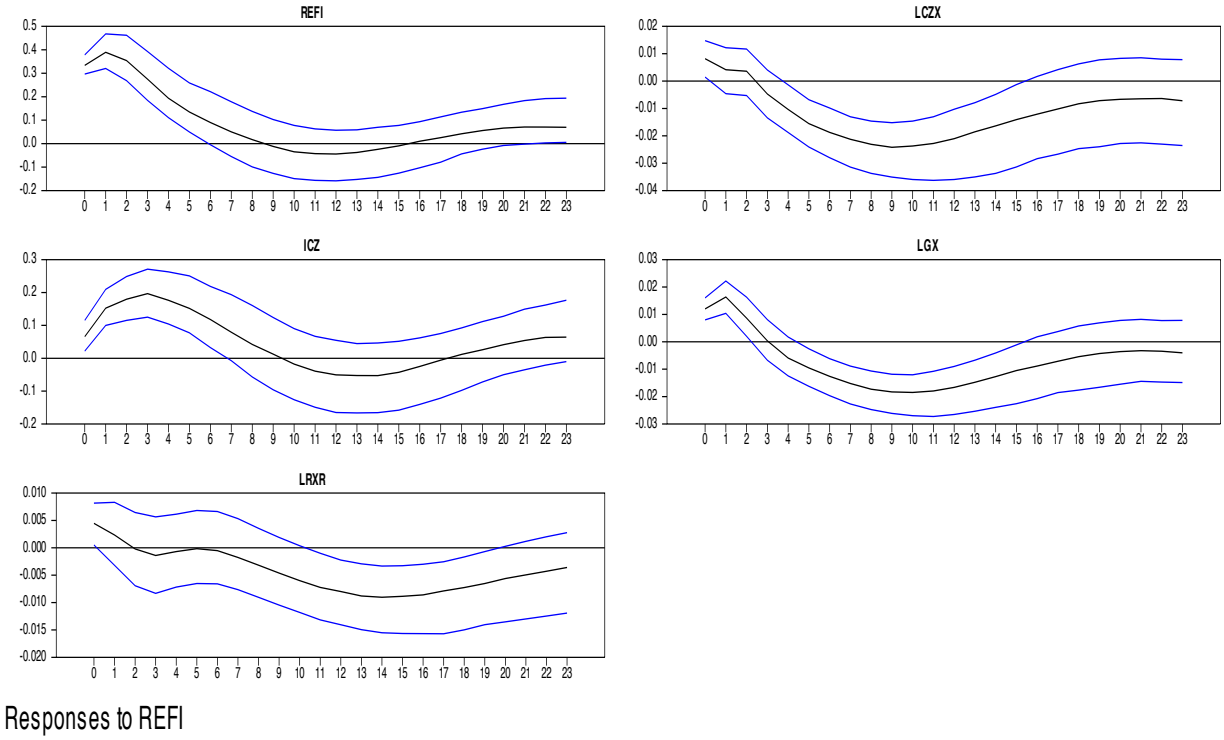
observed for closely-integrated countries in another study of the international transmission of monetary policy (Kim, 2001).

The change in the relationship between interest and exchange rates in the medium- and long-run may be a result of sustained capital inflows, despite low interest rates. These inflows likely result from a combination of the Czech Republic's integrated production chains with Germany[60] and from general foreign direct investment, of which the countries of Central Europe receive quite a bit, both from EU funding programs and from private investors. These countries enjoy more funding than their other East EU counterparts because the level of transparency in these economies are more similar to that seen in the advanced WE economies, thus bolstering investor confidence. Therefore, the better capitalization of banks and businesses resulting from continued flow of funds would finance imports during monetary contractions and (as seen in figure 5.2) boost exports during monetary expansions.

The truth in this prediction, derived from the results of this study, is reflected by the Czech Republic's experience in the 2008 world financial and economic crises. The Czech Republic was one of only a few countries that emerged relatively unscathed. Had there been no FDI into the country, the exchange rate would have continued to be primarily influenced by the highly euro area-influenced interest rates and follow the same path as many euro area and CESEEU countries. However, the Czech economy was well-insulated by keeping foreign reserves high and the current and fiscal account deficits low during calm economic times. In this way, shocks from the ECB monetary policy changes are limited in their reach into the real economy, in terms of exports, in the Czech Republic.

[60] Particularly in regards to automobiles and parts

Figure 5.2: Impulse-responses in the Czech Republic to shocks in the ECB refi rate



5.7 Lithuania

Like Bulgaria, Lithuania has a fixed exchange rate regime vis à vis the euro. As discussed in the overview, the impulse-response of this variable is relevant because I use the real effective exchange rate as the exchange rate variable. With this in mind, it is interesting that the uncertainty bands in the exchange rate impulse response are so wide. In fact, each of the Lithuanian variables display wide uncertainty bands. These wide uncertainty bands, combined with the lack of a statistically significant response in the exchange rate variable, indicate that the response to monetary policy shocks may, in fact, be zero.

Lithuania trades more with Germany than does Bulgaria, so the initial decrease in exports as German exports increase in the first period after the positive refi shock responds perfectly to the short run predictions of the two-country Mundell-Fleming model.[61] However, after the first period, Lithuanian exports begin to increase before converging to Germany's levels in the medium- and long-run. This indicates that the transmission of the shock to Lithuania lags behind its transmission to Germany.[62] Given that changes in the refi rate account for about 20% of variance in Lithuanian interest rates, whereas only about 15% of export variance is accounted for by it, and also that almost 40% of the exchange rate variance is explained by the interest rate, the finance channel seems to be the primary transmission propagator, but with the trade channel also acting as a propagator in the long-run.

The Lithuanian financial sector, like Bulgaria's, is underdeveloped compared to the rest of the EU countries, but is also dominated by WE/euro area banks and financial institutions. Therefore, Lithuania is particularly susceptible to exogenous shocks in the refi rate because they affect WE banks' determination of interest rates, which in turn influence domestic banks' interest rates. As discussed in section 4.2, the transmission to the real economy happens through lending and deposit rates. We can be sure that the interest rate is the transmitter of the shock by looking at its variance decomposition: only the refi rate has any explanatory significance at the initial shocks, while the exchange rate, exports, and German exports have no explanatory significance until after the initial shock.

Nonetheless, Lithuania eventually faces the same problem as does Bulgaria: a lot of pressure is put on its fixed exchange rate. The choices are the same as those laid out in 5.4

[61] Where Country 2 is a small, open economy
[62] This is observed in all the CESEEU countries in this study, with the exception of Bulgaria

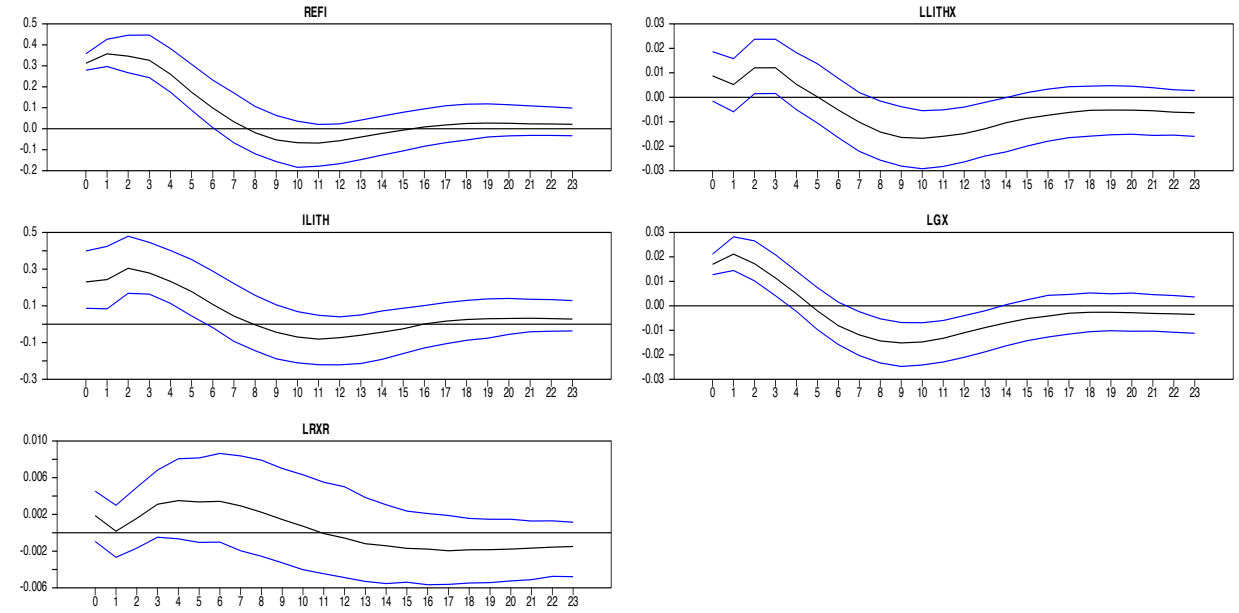
and 4.1, with the choice of adjusting the money supply through the balance of payments as the best remedy.

As would be predicted based off the results of this study, Lithuania was severely hit by a current account crisis, owing to huge deficits, in the midst of the world's economic and financial crises in 2008. In response, Lithuania instituted a heavy, front-loaded fiscal adjustment through internal devaluation. In the first three quarters of the crisis, the Lithuanian government made large cuts in expenditures to successfully avoid the 16% budget deficit, predicted by the IMF, that it would face in 2009. In addition, public wages were cut 20% (Aslund, 2012) and the health and education sectors were restructured for better efficiency. These adjustments improved competitive conditions by lowering the real unit labor cost and the real effective exchange rate. As a result, Lithuania was one of two[63] EU countries with the highest export expansions, which incidentally resulted in the earliest crisis recoveries.

Due to a fixed exchange rate regime, Lithuania's best strategy to mitigate the effect of exogenous monetary policy shocks on its current account is to pursue fiscal measures. Because the Mundell-Fleming model holds in this Lithuanian case and because of the success seen in employing this strategy during the 2008 crisis, this policy suggestion is supported both theoretically and empirically.

[63] Estonia was the other

Figure 5.3: Impulse-responses in Lithuania to shocks in the ECB refi rate



5.8 Poland

Poland is the only country in this sample for which the Mundell-Fleming model does not quite fit at any point of the shock. Over the entire shock duration, both the Polish exchange rate[64] and interest rate rise, and drop simultaneously, as well—contrary to the theory. By taking a closer look at the variables, the refi rate accounts for an average of only about 15% of variance in the Polish interest rate. By contrast, the refi rate accounts for around 30% of variance in the exchange rate while the Polish interest rate accounts for just 9% in the exchange rate. The financial channel does not appear to be the main transmitter of ECB changes into the Polish economy, as it is in the other CESEEU countries. Instead, the exchange rate is the propagator.

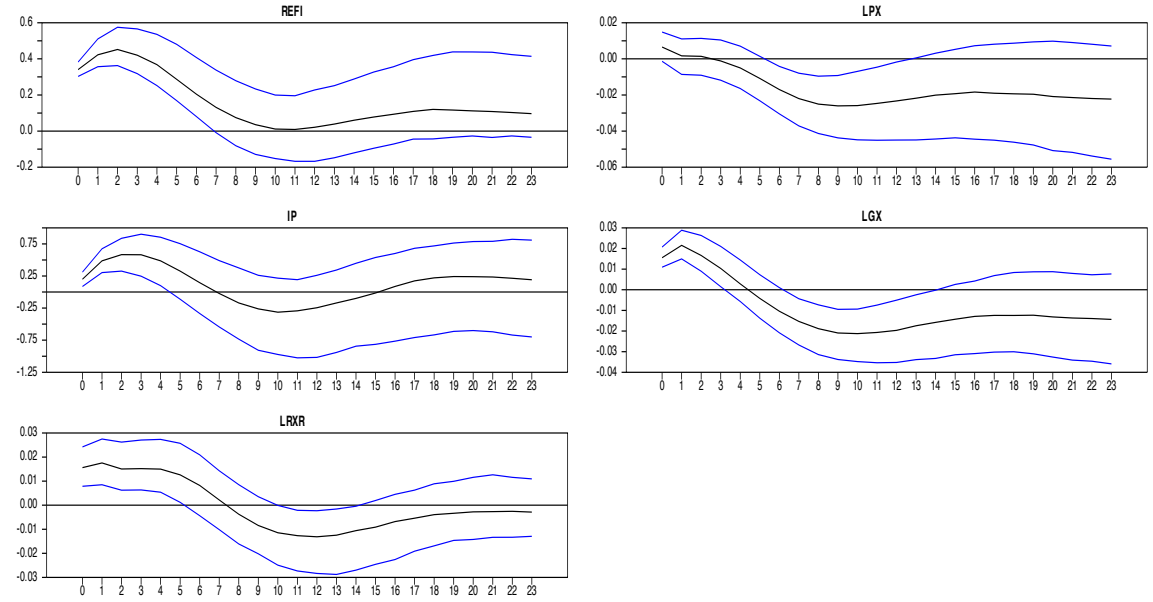
[64] Poland uses a flexible exchange rate regime

The Polish exchange rate explains about 38% of interest rate variance and 23% export variance in Poland. Combined with the fact that the exchange rate is the variable most explained by the refi rate, it appears that WE/euro area FDI into Poland drives its economy. Poland has been on the receiving end of many EU loans and funds since the PHARE program[65] was created in 1989. Given that the finance sector has not grown as much in Poland as in other countries, such as the Czech Republic, it seems that the capital inflows from FDI make the exchange rate the variable most susceptible to the common and country-specific factors described in section 2.1.

In much the same way as the Czech Republic—though the Czech Republic does experience and initial shock through the interest rate—buffers its economy from exogenous shocks, Poland uses FDI funds to better buffer against vulnerabilities in its trade sector by keeping high foreign reserves and low deficits in the current and financial accounts during calm economic times. This is evidenced by Poland's resistance to contraction during the most recent crises.

[65] PHARE: Poland and Hungary: Assistance for Restructuring their Economies

Figure 5.4: Impulse-responses in Poland to shocks in the ECB refi rate



Responses to REFI

6.0 CONCLUSION

This thesis was conducted in order to fill a gap in research by elucidating the transmission pathways of monetary policy shocks originating from ECB changes to the refi rate to the export sectors of the CESEEU, non-euro area countries and to evaluate transmission time and intensity. The findings show that a heterogeneity exists among the CESEEU countries in terms of transmission channel, time, and intensity, but nonetheless follow a similar pattern trending around Germany, indicating high synchronization with the euro area business cycle.

Poland and the Czech Republic show the highest degree of synchronization with Germany, which is very likely a function of the close integration of each one's trading sectors with Germany's. The relative insignificance of the interest rate variable relative to the exchange rate variable in response to the monetary policy shock in these countries, and the importance of the exchange rate variable in explaining variation in the volume of exports indicate that the ECB's change in the refi rate transmits to these economies through trade linkages. This transmission is fast and hits with intensity closely parallel to that seen in Germany.

Bulgaria and Lithuania, on the other hand, are highly susceptible to monetary policy shocks from the ECB through financial linkages, as indicated by the degree to which their interest rates—especially Bulgaria's—change in response to shocks to the refi rate, and the

interest rates' subsequent high degree of influence on export volumes after receiving the shock. Transmission times in these two countries, however, are more delayed than in their Visegrad counterparts. The slow but strong transmission time can be due to several country-specific variables in addition to the fact that they are not as closely integrated with Germany as are Poland and the Czech Republic. These variables include lack of market transparency, government corruption[66], and weak fiscal policies.

This research also reveals the ECB refi rate as a highly relevant monetary policy variable that is capable of inducing changes to both euro area and non-euro area economies. Future studies can use the refi rate variable as a reliable indicator of monetary policy change, and could thus use it to further study the size and impact this aspect of the euro area has on whole regions of the world.

[66] In the case of Bulgaria

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