Chapter 1

Introduction and Background

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1.1. Background

Prices, in economic theory, are the signaling mechanisms via which the problem of scarcity is addressed through the optimal coordination of markets, firms, consumers and the Government. A price represents an agreement between two or more entities to trade something of value at a rate that is mutually beneficial to all those engaged in the agreement. Extending this idea in the open economy framework, exchange rate signifies the price that represents the worth of a country's official currency against other currencies in the international markets. Movements in foreign exchange rate produce important impulses, feedbacks and shocks for an economy that can translate into changes in the macroeconomic equilibrium that may be unfavourable, and may thus warrant policy interventions. It is well-known that the shift from the over-valued pegged exchange rate regime to the Liberalised Exchange Rate Management (LERMS) regime in the early 1990s moved India's exchange rate system to managed floating and the RBI has since then been actively fine tuning the variability of the rupee while allowing its trend to emerge as per the market movements[1]. Given that the exchange rate has now been calibrated more towards a market orientation, the movements in exchange rate have assumed larger importance than they did during the pre-liberalization period.

Large swings in exchange rate can induce impulses whose impacts can ripple across the economy while causing distortions in domestic markets, disturbing the macroeconomic equilibrium, and stressing the monetary and fiscal policies by imposing additional constraints on the space available for them to operate freely. The literature in open economy macroeconomic analysis has located several "international transmission mechanisms" (Acharya, 2013) that can explain the role of exchange rate movements in shaping domestic outcomes as well as the cross-country interdependencies. In particular, the role of exchange rate shocks in determining domestic output and inflation have been the critical areas of debate. Changes in exchange rate are expected to induce changes in output and inflation through different channels and the relative importance of these channels will differ depending on the Balance of Payments (BoP) adjustment approach adopted for the analysis, and the exchange rate regime. The broad consensus is that the RBI follows a managed float regime with primary focus on the variability in the exchange rate (Dua and Ranjan, 2010) while the trend movements are tolerated to a large extent[2]. The basic building blocks of the exchange rate analysis in open economy macro literature surfaces around the role of exchange rate variations in enabling BoP adjustments under different exchange rate regime. The nature of this

adjustment process can have direct implications for macroeconomic outcomes in terms of the stability of growth, rate of expansion of the economy and price stability. Subsequently, exchange rate can be conceptualized as the variable that transmits the effects of events occurring in international markets to the local markets. The transmission role of exchange rate is conditional on the exchange rate regime under consideration. Given the managed floating stance of the RBI, exchange rate movements are expected to directly[3] transmit economic signals emanating from international and global events while necessitating economic adjustments in local markets to maintain the macroeconomic equilibrium.

In an open economy with substantial degree of trade and financial openness, exchange rate assumes primary importance for output determination and inflation. The components of domestic output are behaviorally linked with exchange rate variations, particularly when one looks at the net export component *ex-ante*. Variations in the value of rupee vis-à-vis other currencies can cause changes in net exports, thereby impacting the level and growth path of the aggregate output. Persistent volatility can cause high degree of uncertainty and may induce irregular variations in the domestic output culminating into an uncertain economic environment and distortions of local price signals. On the other side of the spectrum, under relatively freer exchange rate regimes, such as a managed float, exchange rate variations, particularly depreciation, may hyperbole the expansionary monetary policy and cause higher-than expected inflation. With the possibility of overshooting as examined by Dornbusch (1976) and reiterated by Rogoff (2002), the Mundell-Fleming belief of the stabilizing features of floating exchange rates are replaced by the "fear of floating" (Bianchi and Coulibay, 2023)[4]. Divergence between officially claimed regimes and the actual exchange rate management approach were established, among others, by Calvo and Reinhart (2002) who studied the behavior of 154 exchange rate management styles across various economies along with their key macroeconomic performance indicators. There were large discrepancies between the claimed regime and the actual practice and it appears that the movement towards higher flexibility in exchange rate management are is still weak. Such tendencies are generally associated with the inflationary threats of a floating exchange rate and this fear has provided the foundations necessary to expand the scope of pass-through analysis from their traditional focus on trade prices to the larger issue of domestic prices. The understanding of exchange rate variations is the foundation of the analysis of its transmission effects, which are generally connoted as the pass-through effects. The idea of passing through implies that exchange

rate variations must get transmitted to other economic variables through an intermediate variable whose primary function is to absorb the signals generated by exchange rate changes and pass over the same to other variables. This basic premise provides the theoretical genesis of the idea of Exchange Rate Pass-Through (ERPT). Open economy macro literature has examined pass-through effects of several variables, generally assumed to be exogenous[5], such as oil price pass-through and interest rate pass-through, among which one the most debated areas is the estimation of ERPT.

Inflation and exchange rate movements are closely connected due to the phenomenon of ERPT, which is broadly conceptualized as the impact of exchange rate variations on domestic price momentum through the import price inflation. Import price is theorized as the intermediate variable which carries forward the economic pressures generated by exchange rate movements to domestic prices. Thus, ERPT is examined in terms of two functions. The first is the import price function where the import price serves as the dependent variable regressed on several other variables including the exchange rate. The partial elasticity of import price variations to exchange rate fluctuations is captured by the ERPT coefficient. This coefficient forms the basic element of the pass-through process and estimation of this coefficient under different assumptions captured by the type and number of regressors in the import price function occupies the fundamental subject matter of the so-called stage one pass-through. The second is the domestic price function. There are at least two vantage points to theorize this function. One is to consider the consequences of imported inflation for local inflation without removing the effects of exchange rate, while the second approach is to subsume the import price function within the domestic price function while also including exchange rate into the relationship. Naturally, the first vantage point will not provide the pure effect of import prices on domestic prices as exchange rate variations are not controlled for. Thus the second vantage point has been the basic guiding force behind the empirical research on ERPT. While the literature has connoted the influence of currency variations on local prices as the stage two pass-through, this practice seems to be a misnomer because conceptually speaking, the second stage in this process is the transmission of the change brought by exchange rate in import prices, through the import price variations itself, to domestic prices, without allowing the direct effects of exchange rate on domestic prices. Simply put, exchange rate variations may transmit to domestic prices through other channels such as export price variations, and thus the inclusion of exchange rate into the domestic price function with the nested import price function

implies accounting for both the direct and indirect effects of exchange rate movements on domestic prices. This approach has generally been adopted in the empirical literature in India.

The traces of ERPT concerns in the Indian context can be found in the role of exchange rates in trade balance adjustment process. The early 1990s saw increased attention on locating empirical evidence for the fulfilment of the Marshall-Lerner conditions. Simultaneously, the empirical literature on Purchasing Power Parity (PPP) revealed that the implicit assumption of complete pass-through of exchange rate shocks to domestic inflation[6] was not always true. Incomplete pass-through was found to be the norm for the advanced economies while the small open economies showed evidence of complete or even more-than-complete pass-through. As the smaller economies began integrating into the international trade and financial networks, the need to understand how exchange rates would affect the domestic economy gained traction. The Indian economy has been no exception to these developments.

The gradual easing of the exchange rate controls since the economic reforms of 1991 increased the attention on the fears of floating regimes and forced the attention of analysts to the nexus between exchange rate movements and domestic economic conditions (Levy-Yeyati and Sturzenegger, 2000). One of the most debated issues in this regard was the ways in which exchange rates could impact domestic prices both in the short and long runs. The nexus between exchange rate and domestic prices have profound implications for a host of macroeconomic processes. The Balance of Payments adjustment process, fulfilment of the interest parity conditions, nature of trade balance adjustment, fulfilment of the PPP conditions, and several other matters are strongly dependent on implicit assumptions about the nature of pass-through process. Moreover, monetary policy management requires control over domestic prices and the exchange rate channel can distort this control, possibly causing serious misalignment between the policy objectives and policy outcomes. These factors have resulted in a large literature on pass-through mechanism, including estimating its level for different kinds of economies, analyzing its determinants, studying its short and long-run dynamics, and other related matters.

The early literature on ERPT in India adopted the standard approach of estimating an import price function that was grounded in macroeconomic theory. With the emergence of the new open economy models, ERPT models began incorporating the pricing dynamics of foreign exporters into the theoretical frameworks. The fundamental idea behind the theory of ERPT is that

exchange rate changes induce changes in trade prices, i.e. both the imports and exports prices, and import prices in turn because changes in domestic prices as imported goods are a part of domestic consumption – both as inputs and as final goods. However, this channel of transmission is not as neat as it seems and there are several leakages in this transmission process that can cause deviations in the behaviour of ERPT from theoretical expectations. The influence of exchange rates on import prices is generally termed the stage-I pass-through while the effect of import prices on domestic prices due to exchange rate shocks is termed stage-II pass-through. It is very much possible that the quantitative extent of both types of pass-through may be different. In general, it has been found that stage-I pass-through is larger and more rapid than stage-II pass-through in the Indian context.

The analysis of stage one pass-through has important implications for several open economy macroeconomic issues. First, the stage one pass-through directly shapes the demand elasticities of imports and exports and thus has an important impact on the fulfilment of the so-called Marshall-Lerner conditions. Second, this implies that the efficacy of exchange rates in enabling adjustments in trade balance depends in part on the quantum of pass-through. If ERPT is complete, for example, quantity changes in imports and exports would be possibly higher and thus allow smoother and quicker trade balance readjustments in the wake of external shocks. Third, the Purchasing Power Parity (PPP) hypothesis requires that pass-through is complete and one of the components of the full pass-through process is the stage-I pass-through. Fourth, fiscal management focuses on the trade balance and in the Indian context, the current focus on substituting domestic production for imports, the extent of stage-I pass-through is an important factor to be taken into account. Fifth, the tariffs and taxes levied on imports are essential tools to regulate the demand for imports in the country. The extent of stage one pass-through has sizeable implications for the efficacy of these trade restricting policies. For example, if the pass-through to import prices is low, the Government will have to largely depend on tariffs in order to induce expenditure switching away from imported inputs and final goods towards domestic production. In case pass-through to import prices are high, such tariff policies may end curbing the imports and their growth excessively, which can also be equally harmful.

The analysis of stage two pass-through, i.e. the effects of exchange rate changes on domestic inflation, has even more profound macroeconomic implications. First, as stated earlier, the fulfilment of PPP and interest parity conditions require complete pass-through and this

warrants an analysis of the actual extent of ERPT. Second, the RBI has adopted a managed float for a long period. With interventions in the foreign exchange market only when necessary, India has moved towards a more flexible exchange rate regime. However, the challenge of the 'impossible trinity' results in policy trade-offs that need to be accounted for while designing the monetary policy (Joshi, 2003). In the Indian context, price stability has been the primary aim of the central bank and thus it is necessary to know the empirical extent of ERPT to determine the extent of required forex market interventions. In case of a high ERPT to domestic prices, the RBI will be forced to assume larger exposures to the foreign exchange markets and vice-versa. Third, trade and tariff policies require knowledge of the degree of market power that domestic sellers enjoy relative to foreign sellers. Asymmetry in market power between domestic sellers (Indian exporters) and domestic buyers (Indian importers) can have sizeable implications on how well the tariff barriers act in shifting domestic consumption to domestic goods and also in thwarting competitive pressures from foreign sellers in the domestic market. One way in which the policymakers can gauge the degree of market power enjoyed by domestic agents in the international market is to analyze the extent of ERPT (Przystupa and Wróbel, 2011). High ERPT to import prices generally implies higher market power for foreign sellers in the domestic market while higher ERPT to export prices implies for a country implying lower market power of foreign consumers and higher power for Indian exporters. Fourth, as a logical corollary to point third, it can also be ascertained that the success of export promotion policies depends on the extent of ERPT to export prices charged by Indian exporters in terms of foreign currency. If export promotion measures allow domestic producers higher cost advantages, the reduction in the costs should be passed over to the prices charged in foreign currencies to exploit this advantage. However, if Indian exporters do not enjoy higher market power in the international markets, then possibly they will not be able to pass over much of the reduced costs to foreign prices. In case the ERPT to export prices is high, this policy-induced cost reduction could be passed over to foreign prices and thus possibly induce a sizeable shift in the international demand towards domestic production. Similar inferences can be drawn concerning foreign sellers and the extent of ERPT to import prices in India. There are a host of other macroeconomic and industrial policy issues that can be shown to be closely dependent on the extent of pass-through to domestic prices.

It is thus not an overstatement to suggest that the analysis of ERPT has profound implications for not only the behaviour of exporters, importers and domestic consumers but also

for the aggregate economy and how macroeconomic objectives manifest themselves via policy interventions. The empirical knowledge of ERPT can enable policymakers to better integrate external shocks into the ambit of domestic macroeconomic management. A lineage of analysts has delved very deep into the nature of the ERPT process while focusing on its determinants, time-series behaviour, spatial heterogeneity and nexus with other macroeconomic phenomena. However, the primary focus of these analyses has generally been the advanced industrial economies and only recently has there been increased attention towards emerging economies. The literature on emerging economies is relatively recent and has been quite limited to economies that are seemingly on the verge of transforming into more advanced economies. The lack of focus on emerging economies is primarily due to data constraints. India has not been an exception to this. It is only recently; in the early 2000s that ERPT began getting attention among policymakers. Despite the attention to this issue, its analysis has been limited to estimating its empirical extent and possibly its determinants. Compared to the scope of analysis on the advanced economies in this regard, considerable room remains open for more detailed insights.

1.2. Theory of Exchange Rate Pass-Through

Exchange rate variations can induce price, quantity and mixed effects. The quantity channel primarily focuses on the estimation of how exchange rate changes impact trade volumes and real output while the price impact concerns itself with the nexus between exchange rate changes, and trade and domestic prices. It is in the second domain that the ERPT issue has emerged which specifically focuses on the causal nexus between exchange rate, import prices and domestic prices[7]. The basic question in this regards is why and how the import prices and domestic prices react to exchange rate variations? Exchange rate, import price and domestic price are all different incarnations of economic prices. Pertinent to this question is the need to locate the economic mechanism that governs the nexus between these three prices. While it is the interconnections between prices which is of concern, the actual transmission of exchange rate changes within the pass-through process emerges from both price and quantity forces as far as the macroeconomic approach is concerned. Macroeconomic models that assume complete price flexibility generally infer complete ERPT to import and local prices, while those models that allow for price rigidities tend to support the incomplete pass-through hypothesis[8]. Essentially, the existence of incomplete pass-through emerges from the non-fulfilment of the PPP condition and one of the early studies

highlighting the role of nominal rigidities and inflationary environment in producing incomplete pass-through could be found in Taylor (2000) also termed as the Taylor's hypothesis[9].

Inflation is the primary concern of pass-through analysis though other economic issues such as growth, BoP adjustments, and interest rate determination are also affected by the extent of pass-through. Primarily, the pass-through analysts have theorized exchange rate variations as a source of inflationary momentum that can distort the signaling function of prices across the board starting from trade prices all the way to local retail prices at commodity level. In the international finance literature, the BoP adjustment approaches can be utilized to hypothesize different scenarios on the extent of pass-through. For illustration, the elasticity approach to balance of payments adjustment generally presumes complete pass-through to allow the domestic price of imports to adjust rapidly and fully to exchange rate changes (Thirlwall, 1982). However, empirical evidence has time and again pointed out the incompleteness of pass-through for not only advanced economies but also for emerging economies, thereby giving rise to the Pricing-to-Market (PTM) hypothesis. BoP adjustments focusing on expenditure switching policies need to account for non-instantaneous and incomplete reaction of trade prices to exchange rate changes. Similarly, in the monetarist approach to balance of payments adjustment, the PPP condition is presumed and complete pass-through hypothesis emerges directly from this condition (Acharya, 2013). However, it is clear that the pass-through assumption is a theoretical idea rather than an empirical fact, and data do not seem to lend much support to complete pass-through hypothesis. The idea that the foreign exchange rate is purely a nominal or a monetary phenomenon is challenged by incomplete pass-through and the partial nature of pass-through in empirical studies have given rise to the entire lineage of works on this subject matter. Were pass-through to be complete everywhere, it would not have posed much of a concern in the empirical macroeconomic research. The idea of complete and instantaneous pass-through as ingrained in the monetarist tradition has not withstood the empirical findings in case of several emerging economies including India[10].

Given the above background, one can theorize ERPT as a component of the larger inflation determination mechanism. Inflation has perplexed the classicals and Keynesians alike. Both schools have advanced different explanations on the nature, determination and implications of the rise in general price level and the subsequent fall in the average purchasing power of money. However, an important difference between these two competing perspectives of macroeconomics is the implicit treatment of the ERPT issue. While the classical school and its extensions assume

complete long run pass-through with the possibility of incomplete pass-through in the short run, the Keynesian school and its extensions allow for persistence in the incompleteness of pass-through effects of exchange rate. Hence, short run incompleteness of pass-through can be contextualized within both the classical and Keynesian approaches. Rationalization of the persistent long-run incomplete pass-through is different under both the perspectives. The classical macroeconomic framework would not accommodate a persistently incomplete long-run pass-through because that would imply persistent nominal rigidities. At its heart, the ERPT relationship is a connection between prices and thus breakage in the flow of changes and shocks across these prices would imply persistent nominal rigidities. Such an occurrence would generally be ascribed to distortions by the Government within the classical tradition. The Keynesians would probably ascribe the persistent incompleteness to structural distortions in the international goods markets due to factors such as staggered price setting by imperfectly competitive exporting firms or possibly due to contractual bottlenecks set by menu costs or maybe on account of switching costs which may persist for longer periods. The idea of asymmetry in size and direction also emerge from these concerns and perhaps can explain persistence of incomplete pass-through in the longer run also.

The debates on pass-through issue thus occur when the empirical extent of transmission effects from exchange rate variations are not fully absorbed by the trade prices and thereafter from trade prices into the domestic pricing chain. Explanations for this phenomenon have given rise to different approaches as examined in the next chapter. However, there are two major frameworks within which pass-through analysis is conceptualized. The first is the macroeconomic approach that focuses on the role of nominal rigidities in preventing the prices from fully representing the exchange rate movements. Such an approach has generally resulted in the inference that monetary policy transmission mechanism fundamentally changes when pass-through is incomplete and there is deviation from the law of one price for imports (Monacelli, 2003). The basic pass-through relation emerges from the Phillips curve analysis within the new Keynesian tradition and the specification of the complete pass-through process is undertaken therein. The domestic inflation function is specified while keeping the elements of the short-run trade-off between inflation and output while expanding the set of explanatory variables to include macroeconomic aspects as suggested by the variation of the Phillips curve relation adopted by the analyst. Oil prices, average level of inflation, its persistence and variability, exchange rate volatility and interest rates are

generally captured within the macroeconomic approach to pass-through analysis. The idea behind the macroeconomic approach is to hypothesize the pass-through effects of exchange rate on domestic prices as emerging from aggregate relationships rather than purely from microeconomic optimization. The need for aggregation is inherent in this approach and data that are employed are also macroeconomic in nature, thereby inducing the analyst to focus on the larger view on pass-through dynamics rather than disaggregated insights. Indeed, it has become increasingly possible to incorporate detailed and granular data into macroeconomic studies of pass-through, but the scope for such an exercise is limited in the Indian context due to data restrictions. As discussed later, the macroeconomic framework has been the hallmark of pass-through analysis but it has increasingly been challenged by another approach.

The microeconomic approach to ERPT has provided an alternative philosophy of rationalizing the incompleteness in the transmission of exchange rates changes on domestic prices, including import prices (Betts and Devereux, 2000). Under this approach, the fundamental specification of pass-through relationship emerges from the pricing decisions of imperfectly competitive exporting firms who choose the level of pass-through depending on a host of demand and supply side factors. This approach is one of the two explanations for the violations of law of one price[11]. The exporting firms are assumed to possess a positive degree of market power. This provides the backdrop for mark-ups[12] to vary endogenously to the exchange rate changes and thus provides an explanation of why prices may not fully reflect exchange rate changes. Different explanations have been advanced to explain the sources of variations in mark-ups within this approach as examined in the next chapter. Primarily, the menu costs, switching costs and transaction costs are considered as the sources of variations in the mark-ups. Within a perfectly competitive setting, exporting firms will not bother with absorption through mark-ups because mark-ups will be non-existent under such circumstances. The only way in which any exchange rate variation can be handled in this case is through the change in the price of the commodities. Thus, this framework relies on explaining the sources of mark-up variations through which the issue of incomplete pass-through is pitched.

Given the above background, the next section elaborates the motivations underlying this study, the major objectives and the underlying hypotheses to be examined later in the chapter. The remaining chapter discusses the key empirical dimensions of this study by examining the nature

of the variables to measure the fundamental elements of the pass-through relation and also comments on the data environment within which the empirical work is undertaken.

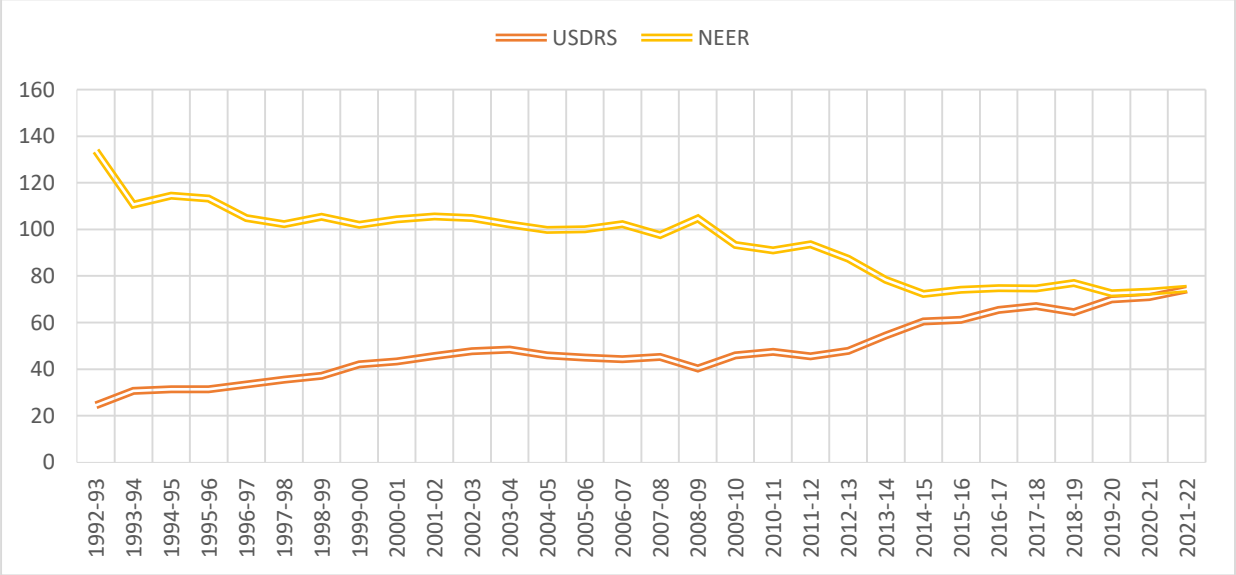
1.3. Motivations, objectives and key hypotheses

1.3.1. Fundamental motivations

The primary concern of this study is with the interconnections between exchange rate movements, import price behavior and domestic inflation for the Indian economy at the aggregate level for the period after the economic reforms. The economic mechanism via which these three variables are interlinked is broadly termed as ERPT in the contemporary macroeconomic literature. This study attempts to study the pass-through process by organizing its analysis in three empirical chapters, each of which examines an important aspect of the mechanism through which exchange rate changes are transmitted to domestic prices.

Indian rupee has largely been a depreciating currency when pitched against the US dollar or against the basket of currencies of important trading partners. Tables 1 to Tables 6 exemplify this observation in quantitative terms, when one observes the mean value of USDRS(g) and NEER(g) across 1991-92 to 2021-22.

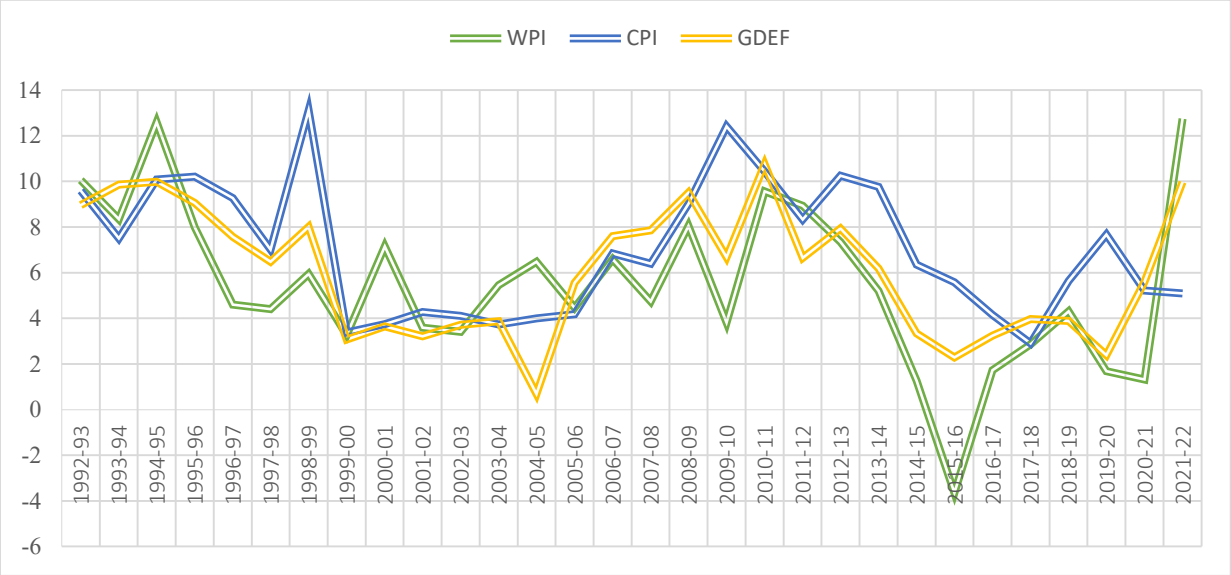
Figure 1.1: Movements of the bilateral and effective exchange rates of the Indian rupee across the sample period



Source: Author's estimation.

Alternatively, the movements in the bilateral exchange rate and the NEER of the Indian rupee as shown in Figure 1.1 can be observed to note the largely depreciating tendency of the value of Indian rupee in terms of other currencies. Coinciding with the depreciating rupee has been the consistently inflationary environment in India as can be located in the mean values of WPIAC and CPI-IW in the previous section. Similarly, Figure 1.2 represents the consistent inflation at the wholesale and consumer price fronts including for the aggregate GDP deflator.

Figure 1.2: Inflationary environment in India across 1991-92 to 2021-22

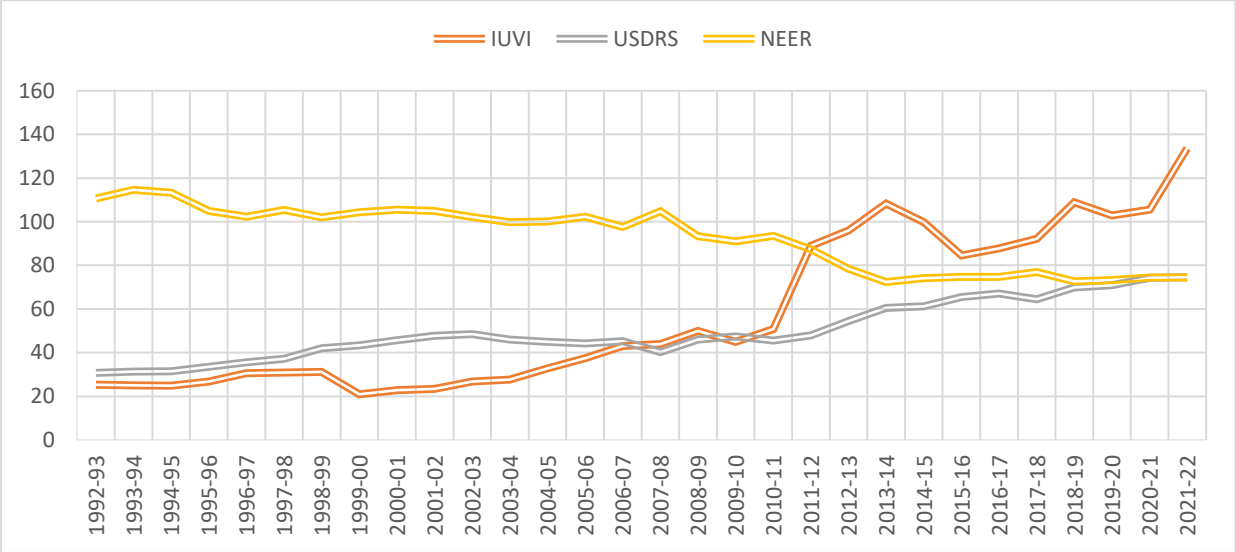


Source: Author's estimation.

Irrespective of the perspective that one adopts, there is a secular tendency of inflating prices at different levels in the pricing chain. The use of either the wholesale or consumer price index inflation may hide the price movements in several important industries, particularly in the services sector. This problem can be addressed by employing the aggregate GDP deflator, which covers larger number of commodities, industries and broader price movements in the economy. Prices have inflated at all fronts with the exception of WPI which decelerated sharply and deflated briefly during 2014-15 to 2016-17. While the rate of inflation has been varying across the period, the prices have largely expanded, and one may locate the possible reasons for this through the descriptive assessment undertaken in previous section. The important link in the complete ERPT process is the role of trade prices, in particular the import prices. The movements in exchange rate are expected to be transmitted into the wholesale and consumer prices via the variations in import

prices. The exchange rate elasticity of import prices thus plays a critical role in enabling the pass-through process to work effectively. Figure 1.3 provides the preliminary indications on this issue.

Figure 1.3: Co-movements in exchange rate and import prices in India



Source: Author's estimation.

There is a presence of a noticeable trend in all the three variables show in Figure 3. The trend in the bilateral exchange rate and the NEER indicate depreciating movements in the value of Indian rupee while the upwards trend in the import prices, proxied by the Import Unit Value Index (IUVI) signifies the continuously inflating import prices. While these observations are correlational in nature and do not imply causal connections, the co-movements in exchange rate, import price inflation and domestic inflation, as indicated in Figures 1.1, 1.2 and 1.3, can serve as a preliminary indication of the ERPT process in motion. The literature on ERPT has emerged out of the existence of such co-movement among the three key variables and the empirical analysis to be conducted in this study banks on this initial observation. If exchange rate, import prices and domestic prices have displayed variations that seem in tandem with each other, this begs the question of explaining such a behavior through an economically meaningful mechanism. The movements in exchange rate are reflections of the market dynamics in terms of the demand and supply side factors that are continuously adjusting to the shocks and changes occurring on the international and domestic fronts. Appreciations and depreciations are important movements in the value of a currency when the forex market is adjusting the relative price of the currency to suit the current sentiments and expectations of the economic agents. These movements have direct

implications for trade prices due to currency invoicing. Trade contracts, whether pertaining to imports or exports, are invoiced in either single currency or in multiple currencies, depending on the relative market power of the importers and exporters. Changes in exchange rate can have immediate implications for the value of the contract in terms of the invoicing currencies. However, the extent to which these implications get translated into actual variations in trade prices is an empirical question. Similarly, changes in trade prices, in particular aggregate import price index of a country can have consequences for domestic prices. Imported commodities form an integral part of the domestic consumption basket and are also used as intermediate inputs by the domestic producers. Naturally, when prices of imported commodities or inputs change, the consumers may have to bear the increase import prices either directly, via the price revision of final commodities, or indirectly via the increased cost of production for domestic producers and the consequent pass over of the increased cost to the final consumers. Again, the extent to which this mechanism actually occurs is an empirical question. The crux of this discussion is that while there is an evidence of co-movements between exchange rate, import prices and domestic prices, the extent to which these movements are causally interlinked into an economically meaningful mechanism requires investigation of the complete ERPT mechanism. The fundamental concerns in this regard are the exchange rate elasticities of import prices and domestic prices. The quantitative relationship between exchange rate movements and import price variations are captured by the ERPT coefficient for import prices. This coefficient, $ERPT_m$ is defined as the percentage change in import price inflation rate caused by a one percentage change in exchange rate.

$$\mathbf{ERPT_m} = \frac{\%\ \textbf{change in Price Index}^{\mathbf{M}}}{\%\ \textbf{change in exchange rate}} \qquad \textbf{.... (1)}$$

Where, $ERPT_m$ is the coefficient for the exchange rate elasticity of import prices and m = imports.

The value of this coefficient forms the most important component of the ERPT mechanism. It is expected that the value of the coefficient expressed in equation one will vary between zero and one. In rare cases, the value may violate the upper limit of unity and can show more-than-proportional change in import prices due to a one-percentage change in the exchange rate. Estimating this coefficient is the first fundamental motivation of this study. The major motivation in the literature in analyzing the ERPT process was generally driven by the analysis of trade balance and the larger Balance of Payments adjustments that may occur due via trade prices that may react to exchange rate changes and cause further impact on trade quantities and thus the trade

balance itself. This strand of literature in the Indian context was particularly concerned with testing for the Marshall-Lerner conditions, and the subsequent trade balance adjustments through by exchange rate appreciations and depreciations. Nevertheless, analysts moved much beyond these concerns and began recognizing the importance of exchange rate movements for domestic price variations also. The gradual liberalization in exchange rate management along with increased current and capital account convertibility in India resulted in enlarged scope of the influences from the movements in the value of the Indian currency. Domestic inflation was no exception to this. Increasing flexibility in exchange rate of the rupee could now possibly interfere with domestic monetary management by impact import prices and through other channels such as affecting the interest rates and asset prices, and thus induce changes in domestic prices. This led to recognition of the larger effects of exchange rate variations on the domestic macro fundamentals and this paved way for the recognition of another important pass-through coefficient, as shown in the equation two below.

$$\textbf{ERPT} = \frac{\textbf{\% change in aggregate price index}}{\textbf{\% change in exchange rate}} \qquad \textbf{---- (2)}$$

Equation two has been the main thorn in the ERPT debate and different approaches have emerged that estimate this relationship using alternative econometric methods, data, time periods, and underlying theoretical models. The shift from the import price pass-through to domestic price pass-through of exchange rate opened up new vistas of research and disagreements that demanded larger attention for resolution. The various thematic issues discussed in chapter two can largely be traced to the agreements and disagreements on the correct specification and theoretical model for the equations one and two. The ERPT mechanism strongly rests on the empirical nature of the pass-through coefficients and till date one does not find any settlement on the debates surrounding them. On the contrary, newer debates have emerged that focus on the nature of the quantitative relationship between the numerator and the denominator in equations one and two. For illustration, analysts have argued and found that the change in exchange rate and the change in inflation are not linked symmetrically. The asymmetries are found on account of both the size and direction of exchange rate changes, and these studies have argued that the ERPT coefficients themselves are bound to behave different depending on the size and direction of the change in exchange rate. Such debates have redirected the research on this topic towards the fundamental debate on how and through which theoretical approach should one estimate equations one and two. These debates

were examined in chapter two, but it is important to note here that the simple pass-through relationship shown in equations one and two have encouraged a voluminous literature in the Indian context and this study derives its motivation to focus on this topic from these fundamental debates.

1.3.2. Primary objectives

With the above background, this study undertakes empirical examination of how exchange rate variations, import price behavior and domestic inflation are interlinked causally for the Indian economy at the aggregate level during the period succeeding the economic reforms using data from official sources.

The first key objective of this study is to systematically analyse the extant wisdom on ERPT estimation in the Indian context. Many issues have been debated in the Indian context, and a large literature has developed in this regard. With the voluminous literature spread across different themes with diverse theoretical and methodological frameworks, it is necessary to summarize these analytical developments into a coherent narrative. The chapter two of this study undertakes this task from both appreciative and critical perspectives. Such an exercise will provide some degree of systematization to the debates, disagreements and consensus on the analysis of ERPT in the Indian context. The second objective is to empirically estimate the quantitative relationship between exchange rate variations and domestic prices including the import prices with suitable econometric exercises in the Indian context. The beginning point in the pass-through analysis is to estimate whether the extent of pass-through is partial, complete or more-than-complete. The primary tactic in this exercise is to estimate the so-called pass-through coefficients, whose basic nature is expressed in equations one and two previously. The pass-through coefficient is defined as the exchange rate elasticity of domestic prices, or more specifically, the percentage change in domestic prices for every percentage change in the exchange rate. The closer this coefficient is to unity, the more complete is the extent of pass-through. The closer it is to zero, the lower is the pass-through effect of exchange rate changes on domestic prices. In some cases, this coefficient can be larger than unity, indicating more than complete pass-through. There is a large debate on the actual cause of the empirical behaviour of pass-through coefficient. Hence, this study attempts to locate the major macroeconomic causes for the way pass-through relationship has behaved in the Indian context since the economic reforms.

The third key objective of this study is to investigate the macroeconomic factors affecting the observed pass-through within the open economy macroeconomics literature. While the empirical estimates of ERPT are essential building blocks in the larger macroeconomic analysis on this topic, one also needs to locate the factors that can explain the rationale behind the way the estimated ERPT coefficients behave. The knowledge of the empirical effect of these factors on the ERPT coefficient can then be used for possibly designing policies that can minimize the negative feedbacks from exchange rate shocks and probably improve the ability of favourable exchange rate variations in improving the trade balance and decelerate the inflation rate. The literature on this matter consists of two major schools, as discussed earlier. One focuses on locating the so-called microeconomic influences in terms of marginal costs, degree of market power and mark-up variations to explain how exchange rate affects domestic inflation. However, growing dissatisfaction with this unilateral focus on industry and individual agents-based approach has allowed the macroeconomic school to emerge. In terms of the macroeconomic factors, several causes have been located in the Indian context as discussed previously in chapter two. The third school that has emerged in this regard takes into account both the microeconomic and macroeconomic factors together into the ERPT estimation. Under this approach, the fundamental equations of import prices, producer prices and consumer prices at the aggregate level are derived as aggregations of the microeconomic pricing behaviour of foreign suppliers. These equations are then expanded to account for macroeconomic factors such as oil prices, exchange rate volatility, inflation persistence, degree of openness, and others. Chapters four and five shall address these objectives. The fifth objective of the present study is to assess the issue of dynamic interactions between exchange rate, domestic prices and the real sector in the Indian economy for the chosen period.

The sixth motivation is to estimate whether there exists asymmetry in the behaviour of the pass-through relationship in India. In recent times, it has been recognized that the reaction of domestic prices to exchange rate shocks can differ depending on the size and direction of the initial exchange rate change. This gives rise to size and directional asymmetries in the behaviour of pass-through relationship. Directional asymmetry in ERPT poses a challenge to monetary policy as the stance of the central bank has to be determined depending on the direction of the exchange rate shock, which in itself can be uncertain in the first place. In such a scenario, it is very much plausible that depreciations may increase the existing domestic inflation while appreciation may fail to bring

any sizeable reduction in inflation whatsoever, depending on the local nominal rigidities. Such concerns are raised by the existence of asymmetric ERPT. This study shall test the hypothesis of the existence of asymmetry in the Indian context and also examine the difference in the ERPT coefficients for appreciation versus depreciation shocks. This information can be useful for designing both the exchange rate and monetary policies. In particular, policymakers can gauge the inflationary tendencies brought by exchange rate depreciations and design appropriate interventions in the forex market. Similarly, if appreciation shocks are able to reduce inflationary pressures, then the same can be exploited by the central bank in maintaining price stability. Such possibilities are conditional, however, on the extent of asymmetry in the ERPT coefficient and the relative difference between the ERPT for appreciation versus depreciation shocks. This issue is addressed in chapter six.

The seventh objective is to analyze the existence of nonlinearity, i.e. size asymmetry, in the behaviour of ERPT for the Indian economy. The ERPT literature in the global context has recognized the fact that domestic prices can react differently to exchange rate shocks – whether appreciation or depreciation, depending on whether the size of the initial shock is small or large. In general, the literature on advanced economies has found that there is a threshold level below and above which the ERPT coefficient value may differ considerably. This issue has received relatively lesser focus in the Indian context, which may be because the literature on ERPT has started growing only recently in emerging markets in general. The expectations of complete pass-through for small open emerging economies as laid down in Campa and Goldberg (2002) have only recently been looked at from a critical perspective. Data has revealed that this expectation is not always true. The idea of non-linearity implies that not all exchange rate shocks are equally important for domestic price behaviour. Larger exchange rate shocks have generally been found as more important in inducing permanent changes in the time path of domestic prices as compared to smaller changes. The primary debate in this regard is on defining the “small” and “large” changes. Yet another issue of contention is locating the “threshold” level of exchange rate change that is the source of non-linearity in ERPT. Linearity, in this context, is generally conceptualized as the stability of the ERPT coefficient across any quantum of exchange rate change – whether large or small. In other words, a single estimate of the ERPT coefficient should be applicable across all sizes of exchange rate changes. However, evidence in the Indian context has provided some indication that this may not always be the case. Structural breaks may occur in the behaviour

of the ERPT coefficient over time when there are large swings in the exchange rate. Literature has suggested that larger changes are more prone to inducing permanent changes in the ERPT coefficient while smaller changes may be perceived as temporary shocks by import suppliers who may choose not to pass over the same to the Indian markets. Hence, this study shall delve into the existence of the non-linear behaviour of ERPT in the Indian context and also analyze the possible factors causing the same. Chapter six of this study addresses this matter in empirical terms.

1.3.3. Underlying hypotheses

This study attempts to address some fundamental questions about the nature of the pass-through mechanism in India, its determinants and its stability over time in the post-reforms period. The major hypotheses to be tested in this study are explained briefly bellow.

The first issue is to estimate the empirical value of the pass-through coefficient linking the exchange rate variations to import price variations. Literature has termed it the 'stage-I ERPT' coefficient. Exchange rate variations are expected to change import prices due to a host of microeconomic and macroeconomic factors. The main linkage between both of them is provided by the nature of trade contracts among the domestic importers and foreign firms supplying the goods. Under the assumption of an imperfectly competitive imports market with small open economy features of the buyer, it is expected that the stage-I ERPT is complete. In other words, a 10 percent depreciation is expected to induce a 10 percent increase in import prices, implying the pass-through coefficient value of unity. This assumption has been frequently violated by empirical findings in the Indian context. Stage-I ERPT is not complete in many of the cases with evidence in both the directions. This necessitates further analysis on this topic. Hence the first null hypothesis is as below:

H_0^1: The extent of pass-through of exchange rate variations to import prices is zero, i.e. the value of the ERPT coefficient linking exchange rate variations and import price inflation is zero.

The second matter to be investigated is the estimation of the empirical value of pass-through coefficient linking the exchange rate variations to domestic inflation. The larger issue under consideration in this study is the estimation of the complete ERPT process, i.e. the relationship between exchange rate variations and domestic inflation. Often, the stage-II ERPT is used as synonymous with the "complete ERPT" process which is incorrect. Stage-II analysis

should analyse the impact of inflation in the value of imports on domestic inflation after the effect of exchange rate changes on import prices as well as domestic prices have been netted out. In other words, stage-II pass-through should measure the 'pure' relationship between import prices and domestic prices without allowing the interactions of exchange rate variations with any of them. However, this study does not delve into this matter. The analysis of how exchange rate variations affect domestic inflation is rather a much larger issue and includes the combined effects of the stage-I and stage-II processes simultaneously within its ambit. Estimation of the stage-I pass-through is essential to estimating the complete process and also to finding out the value of the stage-II coefficient. In general, it is expected that the pass-through of exchange rate variations to domestic prices will be lower than that of stage-I pass-through. In the literature, this is primarily attributed to the distributional leakages that may occur as different agents across the value chain can absorb exchange rate shocks for competitive objectives such as maintaining market shares or due to the classic staggered pricing problem wherein the pricing contracts are pre-determined and can assume short-term rigidity thereby allowing local prices to react to import prices only after certain intervals rather than instantaneously. Thus, the ERPT coefficient, in this case, is expected to be less than one in value. The null hypothesis in this context is as follows.

H_0^2: The ERPT coefficient linking exchange rate variations to domestic inflation is equal to zero.

The third matter of investigation is that of directional asymmetry in the pass-through process linking exchange rate variations to import price fluctuations. As discussed earlier, ideally, the value of the ERPT coefficient is expected to be symmetrical irrespective of the whether there is an appreciation or deprecation. In other words, the implications of exchange rate changes for import prices should exactly be the same irrespective of whether there is an appreciation or a depreciation in the exchange rate. However, recent evidence has suggested that this may not always be the case. It has been found that deprecations in the exchange rate have caused a larger response in import prices as against appreciations. Thus the stage-I ERPT coefficient is expected to be unequal for appreciation and depreciation episodes of exchange rate variations. In general, the stage-I ERPT coefficient for depreciation is expected to be larger than that of appreciation. This implies that foreign sellers tend to pass over inflationary changes much more than deflationary changes to India's import prices. The underlying null hypothesis in this regard is as below.

H_0^3: Pass-through coefficient for depreciation will be equal to the pass-through coefficient for appreciations in the exchange rate for the import price pass-through relationship.

The fourth issue is the analysis of size asymmetry, i.e. non-linearity, in the stage one pass-through process. The issue of non-linearity has been discussed earlier in the previous chapter. The underlying issue is that exchange rate changes must cross a certain threshold level above which there shall be enough incentives for foreign firms in passing over the exchange rate variations to Indian import prices. The main debate rages over the correct approach to determining the threshold level. Chapter four of this study addresses this matter. The null hypothesis in this regard is given below.

H_0^4: The pass-through coefficient for changes in exchange rate above the threshold will be equal to the pass-through coefficient for exchange rate changes below the threshold level as far as import price pass-through is concerned.

The fifth concern is the analysis of directional asymmetry in the complete pass-through process. Similar to hypothesis three, literature in the Indian setting has found that domestic prices tend to react differently to appreciation versus depreciation of the Indian currency. This occurs for at least three reasons: one, there can be asymmetry in the import price pass-through process which gets transmitted into the domestic price pass-through; two, there may be an asymmetric effect of import prices on domestic inflation itself, i.e. asymmetry in the stage two pass-through. Lastly, domestic inflation may itself react differently in direct connection to the exchange rate variations without considering import prices in the relationship. The second reason states that the import price elasticity of domestic inflation may be different depending on the direction of change in the exchange rate. The first reason has been explained in the analysis of the third hypothesis earlier, and the third reason implies that exchange rate variations may cause changes in domestic inflation via channels other than import prices. If the third reason is the primary cause, then one has to move beyond the ambits of ERPT analysis and look into other issues such as oil-price pass-through. The extant literature has located several justifications for such a behaviour of domestic prices in connection with exchange rate shocks in different directions. Among the many factors, one reason can be that the domestic consumption basket is not much import oriented – either in terms of foreign goods or in terms of imported inputs. Thus, depreciation may induce inflation in import prices but due to the low imported content of the domestic consumption basket, such changes may

not pass over at all. While, in case of appreciation, import prices may deflate and this could induce a shift in domestic consumption towards foreign goods and inputs, thereby causing a reduction in the inflation level as consumption is shifted towards cheaper imported substitutes. However, the extant wisdom on this issue is in the very early stages of debate. The current belief is that depreciation should cause a larger impact on domestic inflation as compared to appreciation because imported components have a sizeable space in India's domestic consumption basket. Moreover, it has been observed that given the low market power of Indian importers, i.e. the lack of monopsony, the probability of inflationary changes being passed over to domestic prices is much larger than deflationary changes. The basic hypothesis in this regard is represented below.

H_0^5: The pass-through coefficient for depreciation in the exchange rate will be equal to the pass-through coefficient for appreciation in the same concerning the effect of exchange rate variations on domestic inflation.

Sixth, the analysis of non-linearity, i.e. size asymmetry, in the full pass-through process is examined in this work. As already explained in hypothesis four, not all exchange rate changes are expected to induce an equal response in domestic prices. Larger changes, generally defined as above the 'threshold level', are expected to cause much larger and economically significant reactions from domestic prices as compared to smaller changes, roughly defined as those exchange rate changes that are below the threshold level. When the exchange rate change is above the threshold level, the ERPT coefficient will be larger and vice-versa. The underlying hypothesis to be tested in this regard is as below.

H_0^6: The coefficient of pass-through for changes in exchange rate above the threshold will be equal to the pass-through coefficient for changes below the threshold level concerning the effects of exchange rate variations on domestic inflation.

The seventh matter under investigation is to locate the key macroeconomic factors affecting the coefficient linking the exchange rate variations to domestic price movements, while also concentrating on the factors shaping the movements in inflation of the aggregate import price and aggregate domestic price. Literature has found that there are several important microeconomic and macroeconomic factors that can explain the observed ERPT coefficient in this regard. The present study concentrates on the macroeconomic dimension in this regard. Hence, a host of

macroeconomic variables have been positioned as key factors that can shape the empirical behaviour of the pass-through relationship. These are enlisted as below:

H_0^7: Macroeconomic factors do not have any significant implications for the pass-through relationship. Within the null hypothesis seven, several other hypotheses are assumed in the relevant chapters, as shown below:

$H_0^{7.1.1}$: Macroeconomic factors cannot explain the behavior of the pass-through coefficients significantly.

$H_0^{7.1.2}$: Macroeconomic causes do not impact the movements in aggregate import price inflation.

$H_0^{7.1.3}$: Macroeconomic forces do not affect the movements in aggregate domestic price inflation.

Specifically with regards to the null hypotheses enlisted above, the important issues under consideration are dictated by variables such as oil price variations, level of inflation, volatility in inflation, exchange rate volatility, trade openness, and monetary policy behaviour, among others. These factors are identified through well-defined theoretical models and contextualized into the larger schema of ERPT theory and empirics. These specific factors utilized to test the null hypotheses 7.1.1 to 7.1.3 are further elaborated in the concerned chapters.

1.4. Data, measurement and other analytical issues

At the heart of any empirical exercise is the data environment in which the analytical work is undertaken. The nature and quality of data determine, in large part, the quality, reliability and robustness of the final inferences. Given the macroeconomic nature of the work undertaken in this study, it becomes necessary to examine the larger issue of macroeconomic measurement and reflect on some philosophical issues before delving into actual empirical scrutiny.

1.4.1. Importance and pitfalls of macroeconomic variables in economic analysis

Empirical economic analysis demands data that are suitable for the theoretical model underlying the issue under consideration. The representativeness of available data in terms of the proximity of such data to the theoretical concepts that are under scrutiny forms the foundation of a high quality economic analysis. Economists employ both primary and secondary data, whose collection,

cleaning, organization and structure are diametrically different. When primary survey data are employed, the economist has some degree of control over the distributional characteristics of the data and can adjust the data collection mechanism to ensure that high quality data are collected. While this may not always be feasible, given the time and financial costs associated with such data collection, there is a remote possibility to determine the quality of data while the collection process is underway. Such data are frequently employed in microeconomic research and it is perhaps one of the most widely used data assimilation approach in diverse areas such as development, industrial, agricultural and financial economics, among some others. The analyst can obtain close access to the statistical units who are under the empirical investigation and the nature of the sample and the sampling strategy itself may be moulded to ensure strict compliance to the postulates of the ideal data.

Contrasting this approach is the macroeconomic research that largely relies on secondary data where the economic analyst does not have any control or access to the underlying statistical units. Under this scenario, the macroeconomist must rely on the data generating process embedded in the information that was collected beforehand. Discovering the process through which the data were generated forms the fundamental concern in any macroeconomic work. The problem of identifying the true relationship underneath the veil of observed variations and correlations among the aggregate variables is a critical challenge in macroeconomic research. The major constraint is in recognizing the correct form of relationship between macroeconomic variables is the aggregate nature of these variables. No other issue is perhaps as debated in the philosophy of macroeconomics as is the matter of aggregation. The emergence of large-scale micro level data sets have complicated the tasks of the macroeconomic analyst even further as highly granular data pose larger econometric challenges in empirical macro modelling. It would not be an exaggeration to suggest that the major portion of macroeconomic research still rests on highly aggregated data. Sound aggregation requires establishing consistent relationships between the macro variables and the micro level economic behaviour underlying these large-scale variables (Green, 1977). Traditionally, this task is undertaken by adopting appropriate aggregation functions and amassing the individual level information into macro aggregates using survey-based data. This approach is largely employed in the construction of key macroeconomic variables in India.

Aggregation allows reducing the consumer and firm level heterogeneities and focus on the broader economic relationships which shape the behaviour of the individual economic agents. Construction of statistically and economically sound macroeconomic aggregates requires high quality samples through which estimates of the macroeconomic variables are derived. The National Sample Survey Office (NSSO), Central Statistics Office (CSO), Reserve Bank of India (RBI), and the other key institutions construct the important macroeconomic variables such as economy-wide employment, output, and estimates of prices and inflation, using sample surveys. These exercises are affected by several issues such as the sampling fluctuations, measurement errors, time lags, and statistical noise, among others. Utilization of such information to build variables that attempt to measure diverse dimensions of economic activity for the entire economy can be extremely challenging and may demand additional caveats when macroeconomic analysts employ these data into empirical work. Primarily, whether the aggregate variable represents the theoretical concept which is being investigated is the thorniest issue in macroeconomic enquiry and several compromises may have to be made to render the available data usable for the research agenda.

While some analysts have asserted that it requires a leap of faith to shift from individual decision-making to large-scale macroeconomic aggregates (Colander, 1993), such aggregation has allowed the investigation of some of the most fascinating topics in economic analysis such as productivity, development, trade, growth and business cycle analysis, among many others. The construction of economy-wide totals of different facets of economic activity has to undertake aggregation. The challenge is in bringing coherence between the microeconomic behaviour and the variations of the aggregate. The classic 'fallacy of composition', as warned by Keynes and several others after him, always lurks the corridors of macroeconomists. This fundamental argument in this fallacy is that there can large discrepancies between the ways in which individuals behave and the behaviour displayed by the aggregates constructed from the individual level data. This incongruence between microeconomic outcomes and macroeconomic outcomes demands the recognition of aggregate outcomes as a separate economic reality in itself. Linking social reality to these aggregates is necessary to meaningfully utilize the information embedded in macroeconomic data (Winkler, 2009).

The socio-economic linkages between macroeconomic data and the economic reality that it attempts to capture depend largely on the quality of the data, the size and composition of the sample through which the aggregate data were estimated, the maturity of the data collection machinery and the wisdom of the data assimilators. These fundamental concerns are the necessary principles based on which aggregate data can be made reliable and robust to statistical and measurement errors. A problem that emerges from these concerns is that the application of traditional economic models, particularly within the neoclassical framework, directly to macroeconomic data can produce inconsistent and spurious results. Hence, macroeconomic models are warranted that can handle the aggregative data while maintaining internal consistency of the theoretical framework guiding the empirical agenda. If such a consistency is to be achieved, then using microeconomic models directly on aggregate data will not be plausible. The Keynesian shift in economic thought is considered revolutionary by many primarily because it laid the foundations for separate recognition of macroeconomic analysis as distinct from microeconomic theorizing. While aggregation poses challenges, both empirical and philosophical, it has allowed policymakers to gauge the larger perspective on economic activity and design appropriate intervention designs that can help shift the economy from one state to another and more desirable state. Debates still rage on the efficacy of purely macroeconomic models and the need to redirect attention towards microeconomic foundations of macroeconomics. However, underlying such voices is the implicit belief that macroeconomic reality does not deserve a separate existence and should be strictly grounded into microeconomic logic. The dominance of methodological individualism is reflected in such critiques of macroeconomic analysis.

While these debates continue to persist, macroeconomic analysis has also continued to flourish in newer vistas, continuously improving humankind's understanding of the economic reality. Moreover, the understanding of macroeconomic measurement has improved drastically in the previous decade and the emerging economies have seen drastic improvements in their macroeconomic data infrastructure. These improvements can be located in terms of the efficiency of data collection agencies, improved methods of data collection, larger and more representative samples, synthesis of diverse data sources, improved statistical procedures and other associated changes. A fascinating development in this context has been the availability of large-scale granular data that can be utilized in macroeconomic modelling while rooting the analysis in microeconomic foundations (NBER, 2023). Such data are capable of allowing analysis using traditional

neoclassical models as well as the newer generation of non-neoclassical models that relax the strict assumptions underlying the neoclassical framework. Use of such data in the Indian context is however limited as their availability is scarce and till date the major source of macroeconomic information are aggregated data from official agencies. Data on production, investments, trade, prices, balance of payments, monetary management, banking and other related areas are available from official agencies that can enable sound economic analysis. However, their usage is restricted by the limitations of such data in terms of the probable measurement and sampling errors, representativeness of the underlying samples, aggregation procedures employed in constructing these data, and the quality of data collection procedure.

The fundamental criticism for pure macroeconomic analysis emerged from Lucas (1976) who argued that macroeconometric evaluation of alternative policies is not possible unless the behaviour of underlying agents is assumed to be constant to policy changes (Silva and Gomes, 2022). Such an assumption was difficult to reconcile initially, but the developments in New Keynesian macroeconomics and the newer open economy macroeconomics allowed incorporating endogeneity of agents' behaviour into econometric modelling. Not all economists have agreed on this criticism and equally vociferous arguments were proposed against the critique. The primary approach to analysing the Lucas' Critique was to engage in testing the fundamental hypothesis underlying the critique, namely that econometric policy evaluations are unreliable as economic agents will change their behaviour, whenever there are policy changes, thus making it difficult to estimate the true effects of a policy using a econometric models whose structure remain unchanged in the light of policy shocks. Such efforts are summarized in Favero and Hendry (1992). Largely, the 'tests' of the hypothesis underlying Lucas' critique have not found much empirical support (Linde, 2001). The critique still remains a profound challenge for macroeconometric modelling but it seems that the empirical implications of the critique are not conclusive yet.

Despite the problems in using aggregate data in macroeconomic analysis, such data allow the construction of macroeconomic variables whose levels and variations are critical sources of information on the socio-economic developments occurring in a country. The social content of the macroeconomic variables is perhaps best captured by the descriptive analysis of these data to gauge the changes occurring in economic activity across space and time (Winkler, 2009). A macroeconomic variable measures a particular aspect of economic activity at very large scales, by

compressing the individual level heterogeneity into broader movements that provide the bird's eye view and allows the analyst to observe the directly unobservable reality. An individual agent engaged in optimization of pre-defined objectives is faced with a limited portion of socio-economic reality in which many aspects, events and processes remain exogenous. When aggregation is performed and macroeconomic variables are constructed, these portions of the reality that were erstwhile unobservable or rather unperceivable become apparent. In turn, the individual level reality is replaced by the sum total of the behaviour of a large number of agents whose mutual interactions may produce outcomes that were not a part of the conscious optimization function underlying the agents' behaviour in their ordinary business. Macroeconomic variables are thus capable of enlightening economic processes that may be construed as the unconscious outcome of the conscious behaviour of firms, consumers and other agents.

There are several gains that are produced by macroeconomic variables over disaggregated data that need further appreciation. First, as noted earlier, macroeconomic variables can measure economic processes that are generally unperceivable to individual agents, but are nevertheless necessary for sound policy formulation. Consider for illustration the aggregate business cycle fluctuations and the industry or firm level cyclical fluctuations. It is possible that while the economy as a whole is moving towards recession, particular industries or firms may be experiencing a different stage in their business cycle and the use of aggregate output will help to gauge the direction of the overall economy, while possibly indicating the future recession in these industries. Second, macroeconomic variables provide access to data that are otherwise inaccessible for common public and analysts. A lengthy statistical exercise is conducted to construct meaningful macroeconomic variables such as aggregate output, capital formation, inflation and others. Voluminous amount of data from diverse data collection agencies are synthesized to generate these variables. Access to such information is made possible by macroeconomic data which otherwise would be difficult to collect for any individual analyst.

Third, the foundations of macroeconometric analysis hinge on the availability of data that are sufficiently aggregative to allow meaningful assessment of macroeconomic hypotheses. Consider for illustration the determinants of economic growth. Favourable structural changes in the economy along with technological progress are necessary to achieve higher growth in the long run. The shift from one state of development to a better state requires progress on-the-average

rather than in every industry, firm or household. In other words, for economic progress to occur, either majority of the components of economy should experience progress or the relative progress of the few components should outweigh the regress of other components. Such assessments are plausible only when macroeconomic data are available that cut across sectors, industries, firms and markets. Fourth, there are several economic issues that are fundamentally aggregative in nature. Consider for illustration the issue of ERPT. While it is perfectly plausible to estimate the pass-through effects for individual commodities, industries or sectors, from monetary and exchange rate policy perspectives, it is the aggregate pass-through that matters the most. Monetary policy, for illustration, is generally not directed towards individual commodities or sectors. Rather, the policymaker requires knowledge about the larger picture abstracted from the commodity-level heterogeneities in pass-through. Information on aggregate pass-through effects of exchange rate variations can help the monetary authority to account for the feedback effects between exchange rate and monetary policy rates and thus design the policy while accounting for such distortions. In the absence of macroeconomic information, the policy formulator will be left to depend on their subjective wisdom and anecdotal evidence which may substantially bias the monetary policy design.

Fifth, macroeconomic variables are capable of handling issues that may not be optimally explored within the ambit of microeconometric analysis. Determinants of inflation is one such illustration in this regards. The concept of inflation is inherently macroeconomic in nature. Even if an analyst can access data on each and every commodity in the price vector required for measuring inflation, she will be required to aggregate these price data into a single index that can meaningfully measure the changes in general price level. Invariably, a macroeconomic variable will be necessary to use inflation as a dependent variable in the analysis of its determinants. In summary, macroeconomic variables provide both theoretical and empirical advantages that allow examination of economic processes that have profound impact on individual agents as well as on the evolution of the industries, sectors and entire economies.

1.4.2. Macroeconomic data environment for this study

The narration in the previous section delved on some elementary philosophical issues in macroeconomic measurement and the importance and pitfalls in using macroeconomic variables for empirical analysis. The crux of the discussion was that an analyst needs to balance the trade-

offs between theoretical finesse and empirical practicality when engaging with macroeconomic data. The current study shall utilize a host of macroeconomic data and undertake aggregate level analysis of the pass-through effects posed by exchange rate changes for import prices and domestic prices for the Indian economy. Invariably, use of official data sources is made to collect these data and lend them useful for the empirical work in this study. This section provides an overview of the major sources of data that have been utilized in this work along with a brief examination of the key variables to be employed in empirical analysis. The basic foundations of the data environment for this study is laid down in this section. Locating the variables presupposes the clarity on the theoretical model adopted in the study. This concern has been addressed at a broader scale in chapter one while the issue-specific theoretical frameworks are discussed in respective chapters later. The aim of this section is to lay bare the important sources of data used in the study, the key variables and some dimensions on their measurement, and to examine the sample period adopted for analysis.

1.4.2.1. Key sources of macroeconomic data

India's macroeconomic data environment is largely dominated by official agencies and the information that they provide in public domain. While alternative estimates may be available from non-governmental sources, the most reliable information are available from the official agencies. In the current study, data from the Central Statistics Office (CSO), Reserve Bank of India (RBI), Directorate General of Foreign Trade (DGFT), Directorate General of Commercial Intelligence and Statistics (DGCIS), and the Financial Benchmarks India Pvt Ltd. (FBIL) shall be utilized as far as data on domestic macroeconomic variables are concerned. With regards to international data such as information on oil prices, world trade, world output and other such dimensions, information from the International Monetary Fund (IMF), Bank for International Settlements (BIS) and the World Bank shall be employed in the study.

Usage of diverse data sources is unavoidable as the data collection machinery in India is decentralized across different agencies who specialize in collecting specific information. There can be wide differences in the data collection procedures, composition of the underlying samples, sampling considerations and aggregation procedures across the sources. However, most of the data to be employed in this work are collected within the ambit of the system of national accounts and other broad principles laid down by each agency in congruence with the larger vision providing

comparable, consistent and high-quality data[13]. This study shall utilize data from these diverse agencies while accounting for possible differences in these data. One source of the differences can be the definitions employed for the statistical units. This can pose serious difficulties in empirical estimations if there are alternative data available for a single variable from two or more sources. In the case of current study, each variable is represented by data from a single source and largely, there are no variables except a few where alternative measures are possible. Moreover, even if alternative measures are available, for illustration in case of measure of domestic inflation, the measures are used separately as complements rather than as supplements. WPI data in India, for example, are provided by the Office of the Economic Adviser, Ministry of Commerce and Industry, while the CPI data are constructed via dual information sources, namely the Labour Bureau and the National Statistical Office. Direct substitution between these two measures is not only conceptually implausible, but also statistically problematic as the underlying sample, definitions, weighting patterns, and data collection approach differ diametrically. The literature on ERPT in India has utilized both the variables for measuring inflation, but each is treated as a separate dimension of inflation.

1.4.2.2. Important measurement issues in key variables of the pass-through process

The first major source of data is the Central Statistics Office (CSO) under the Ministry of Statistics and Programme Implementation (MoSPI). The agency specializes in coordination of the statistical machinery via its various divisions. This study has utilized the data on national accounts statistics collected by the National Accounts Division, that include time-series information on aggregate GDP at factor cost and market prices, gross capital formation, savings, and sectoral output. These data are generally readily available with a lag of one to two years as latest estimates may be provisional in nature due to the delays in the information flow between different agencies. The CSO provides data on these variables for annual and quarterly frequencies. Key debates on these data have occurred on matters such as the base year revisions, weighting pattern for the individual components of the variables, revisions in the weighting structure, and aggregation procedures. Aggregate output, savings and capital formation data are obtained from this source in the present study.

The second major source for the macroeconomic data employed in this study emerges from the RBI which not only collects a large amount of monetary and banking data but also compiles

the data into the Handbook of Statistics which is available in the public domain. The handbooks are one of the most relevant sources of information for the present study. The RBI brings together diverse data sources into these handbooks and also provides real-time data access through the Database on the Indian Economy. The data available from these sources are generally highly reliable, are passed through considerable statistical treatment to lend them useful for empirical analysis. The exercise involved in amassing these data into a single source is massive and there are problems of lags in reporting on some variables, though by and large the current data for most of the variables are readily available. The key information to be used from the RBI in this work include variables such as aggregate bank credit, measures of money supply, monetary policy rates, bilateral and effective measures of exchange rate, and international capital flows.

The third major source of data in this study is the information on international trade supplied in the public domain by the DGFT and DGCSI. The data on aggregate imports and exports, and the broader trade balance data are collected and provided by the DGCSI while the data on international movements of goods in the licensing stage are available from the DGFT which is the nodal agency for assimilating information on these dimensions from the customs unions and other important entry-exist points of international trade flows in India. It is important to note here that the trade statistics in India are collected "as by-products of administrative activity" as stated by the MoSPI in its trade statistics manual. These data are collected through the Shipping Bills and Bills of Entry which every importer and exporter has to fill at the customs offices in ports. The data in these bills are translated into the Daily Trade Returns (DTR) which are then processed further by the DGCSI who treat these returns as the statistical units. Data are received in both physical and digital forms. However, traditionally, the DTR is biased towards transactions undertaken via physical channels and thus the coverage of e-commerce transactions is a major limitation of these data. There are delays in assimilating data due to detailed reports required from traders which are marred by errors at times, and cause delay in processing of the bills data into DTR. This study has employed the data of DGCSI and given the paucity of any alternative sources, the limitations of have to be accepted. Despite its limitations, at the aggregate level, the foreign trade statistics are reliable and generally do not pose much reporting lags.

The more relevant debate in this regard is on the foreign trade index numbers. The DGCSI is the authority for compiling and reporting data on the quantum and unit value indexes of foreign

trade. As is well-known, there is no reliable data on import price index *per se* but the import prices are proxied by the import unit value index. A unit value index is derived by dividing the total trade value by the trade quantity. The resultant value is an average price representative of the import prices, i.e. the average price per unit of the diverse imported commodities contained in the imports data. This index is susceptible to not only the variations in quantity of imports and the relative price variations of commodities in the imports basket, but also to the composition of the imports basket itself. The unit value index may thus vary due to these three factors or a combination of them, thus disconnecting the pure price variations from the composite variations. The variations in the import unit value index may thus not represent the actual movement in the aggregate imports price level and this could lead to incorrect inferences in the pass-through analysis. In general, however, the import unit value index is employed as the preferred measure of import prices due to lack of a reliable alternative. Another possibility is to construct an imports price index from the commodity level data but the coverage at commodity-level is also not free from limitations. The depth of coverage of India's import basket is constrained by various problems as noted previously in this section. Moreover, price data at commodity level for imports are generally not available due to the large diversity of imports in India. This makes it inevitable to employ the unit value index and this study adopts the same approach.

The pass-through framework requires the data on exchange rates. In India, the RBI is entrusted with the task of compiling and reporting the exchange rate data for both the bilateral and effective exchange rates. The broad agreement is that India follows a *de-facto* exchange rate management policy wherein volatility-smoothing is actively targeted by the RBI while allowing the trend in the value of currency to emerge via the market forces. Recent evidence suggests that there is a clear difference within the *de-facto* regime wherein the RBI actively intervenes during episodes of appreciation while allows the fluctuations to emerge during depreciation of the rupee (Patnaik and Sengupta, 2021). The data on the exchange rate are reported by the RBI on daily basis and compiled in monthly and annual terms. The daily data are measured via the 'reference rate' reported by the FBIL. A random fifteen minutes window is selected by the FBIL during which data are collected from selected online platforms, and the variations in the exchange rate of rupee against various other currencies are recorded and averaged out to arrive at the day's exchange rate. This rate is what is considered as 'the exchange rate' on any particular day and the lower frequency data on exchange rate emerge from these rates. The bilateral and effective exchange rates are

constructed using these reference rate data. The effective exchange rates are constructed for a group of select currencies. Earlier, the 36-currency weighted index was used while now there is a new 40-currency weighted index, where weights are either export share-based or trade share-based. Weights of these currencies are updated at longer intervals to reflect the changed preferences and trade structure of the economy.

Lastly, the study has utilized aggregate domestic inflation data at the wholesale and consumer levels using data obtained from the Office of the Economic Adviser, Ministry of Commerce and Industry for WPI, and from the Labour Bureau and the National Statistical Office for information on CPI. WPI estimates are constructed based on elementary price indexes which are item-level price measures which are aggregated further into higher levels of groupings using the Laspeyer's index formula. The prices are aggregated into index from this stage and thereafter are further aggregated depending on the sectors under consideration. A fixed basket of goods is surveyed for price changes and, the prices and changes thereof are captured by the wholesale prices. The transactions whose prices are captured in this index emerge from markets engaged in bulk trading rather than retail trading, which is covered in the CPI measurement. 697 items are covered in the new 2011-12 based WPI. The Collection of Statistics Act, 2008 is used for undertaking the data collection work for the WPI. Manufacturing units and factories are the primary source of information and a sample of the same from the items in the WPI basket are required to submit price information through an online data dissemination mechanism arranged by the Office of Economic Advisor and assisted by the NSSO. The WPI data reporting is extremely sensitive to the reporting timeliness of the source units selected for regular supply of price data. Delays at their end will invariably cause delay in the all other procedures. Hence, provisional estimates of the WPI are provided first followed by final estimates when all the relevant data for the given month are received, albeit with lags. It is important to note that the WPI data at unit level, i.e. for the statistical units are not revealed to maintain business privacy. Several items are not included and the commodity basket of the WPI is not exhaustive. Price movements in the aggregate WPI index, for example for the WPI of all commodities category, may not reflect actual price movements of the entire bulk market as many commodities are excluded but the coverage of items is kept as tightly representative of the bulk transactions market as possible.

The CPI data are constructed by the Labour Bureau and the National Statistics Office, and the considerations on this account are different than the WPI. There are multiple measures of the CPI, with the latest index having rural and urban measures which were unavailable earlier. Another frequently employed measure of the CPI is the CPI for Industrial Workers category (CPI-IW), which has been used in this study. Continuous time series data for the CPI-IW are available while back-dated information on the new CPI are unavailable. Hence, one is forced to employ the CPI-IW series for measuring inflation at the retail level if the time period extends before 2011-12 as the new series is not available before this year. Data on CPI for the Industrial Workers, IW-Food, and Agricultural Workers are available in back-dated terms. Recently, the CPI-IW series was rebased from 2001 to 2016. The "Report on New Series of Consumer Price Index for Industrial Workers (Base 2016 =100)" by the Labour Bureau provided the information on the updated series. CPI data are also based on sample surveys conducted on a fixed basket of commodities collected from selected retail transaction points. The sectors covered by this index consist of Factories, Mines, Plantation, Railways, Public Motor Transport Undertakings, Electricity Generating, and Ports & Docks. The price data pertain to the prices faced by the working class[14] families as defined in the CPI manual. The price data are obtained from 88 pre-selected centres, which are mainly production units where workers are involved, generally referred to as 'establishments'. The Working Class Family Income and Expenditure Survey (WCFIES)[15] is used to select the centers from where price data are to be obtained from industrial workers. A stratified two-stage sampling approach is employed. CPI-IW estimation is based on two important components, namely the weighting pattern, which refers to the expenditure weights for the base period, and the retail prices. Data on retail prices are collected for six commodity groupings defined for the typical consumption basket of targeted respondents of the income and expenditure survey. In total, 317 market places are covered from the 88 centers in the sample to collect price data. These market centers are located based on popularity of these markets as ascertained by the data collection agency using interactions with local players and other secondary sources. The main source of price data are the pre-selected sample shops and these are located in the 317 market places. The 'price' is defined as that rate "which an industrial worker has to pay for the specified item, for the specified unit, in the selected shop of the selected market" (Labour Bureau, 2020). The CPI-IW is considerably sensitive to the information provided by the shops to the data collectors and the entire exercise of constructing the aggregate CPI depends on the quality of price information so obtained. CPI estimation is subjected

to larger variability than the WPI due to inclusion of larger number of markets and retail prices which in local marketplaces which may vary frequently and at times erratically.

1.4.3. Time Period for the empirical analysis

This study has covered the duration of 31 years spanning from 1991-92 to 2021-22 using both quarterly and annual frequencies of time series data for examining the aggregate pass-through process in India. The choice of the starting point of the chosen time period is motivated by the emergence of the economic reforms and the structural adjustment programme as enforced by the IMF when India obtained emergency funding in the wake of the payments crisis and a looming economic downfall in 1990. The period after the reforms has been qualitatively altered as compared to the pre-reforms era. As delineated in section two of this chapter, the growth momentum, its primary drivers, nature of India's international trade, policy regimes on different fronts, monetary and fiscal management philosophies and a host of economic dimensions underwent sea change after the payments crisis and the subsequent reforms. Hence, beginning the analysis from this point provided an opportunity to exclusively focus on the new economic era heralded by the structural policy changes in India's macroeconomic history.

As examined in section two of this chapter, this period was characterized by a large number of domestic and external shocks which shifted the economic progress of India in different directions while the economy remained anchored to the an expansionary path. The period reflected the challenges faced by an emerging economy which proved itself resilient to some of the worst macroeconomic events in its macroeconomic history. The pathways adopted by policymakers during this period, and the strength of the individuals, firms and the markets, came to the fore as the economy surpassed every challenge thrown at it. Indian economy has pitched itself as a leading force in the global and particularly the Asian growth story, while acting as a catalyst for synthesizing a socialist political philosophy with a market-oriented economic regime. The period chosen for study in this work encompasses the narrative of economic resilience, continuous evolution and perhaps the emergence of Indian economy as a leading player in the world economic order. It would not be an exaggeration to suggest that this period is an era in itself as far as the macroeconomic progress of the Indian economy is concerned. Institutions, markets, agents and policymakers have propelled the economy towards stronger macroeconomic fundamentals despite the frequent political, economic and social upheavals that knocked the corridors of India's

advancement. Hence, this study attempts to capture one of the most fascinating periods in the history of India and reflects on one critical aspect of this evolution while making sense of the larger economic reality that surfaces from the interactions between exchange rate, import prices and domestic prices.

1.5. Chapter-wise agenda

This section highlights the key issues investigated in each of the chapters later in the study. Chapter one has provided the empirical background as well as narrated the important considerations on the theory of ERPT, the key motivations and hypotheses to be examined in this study, the data environment within which the empirical exercises shall be undertaken and the time period of the study. Chapter two provides a detailed overview of a large number of evidence on the subject-matter within both the international and the Indian contexts. Thematic debates, agreements and perspectives are extracted from the survey of literature and presented in a compact manner. Chapter three narrates the macroeconomic evolution of the Indian economy with a special emphasis on the open economy features and their development and interaction with the domestic sector over time. The entire sample period is divided into five-yearly sub-periods and each period is examined through the perspective of key macroeconomic indicators such as the occupational structure of the economy, fiscal management, monetary management, foreign exchange market and exchange rate management, the key movements in the external sector and a host of allied perspectives.

Thereafter, chapters four, five and six conduct the empirical exercises pertaining to the issues of ERPT to aggregate import price inflation, aggregate domestic price inflation, and the dimensions of asymmetry and nonlinearity in the observed pass-through relationship, respectively. Specifically, chapter four looks into the short-run and long-run behaviour of ERPT to aggregate import prices. It also engages in the assessment of how import prices and exchange rate variations interact through a host of macroeconomic variables. Furthermore, the stability of import price pass-through coefficient is assessed, and the chapter is concluded with the study of the determinants of the stability in pass-through coefficient. Thereafter, chapter five extends and elaborates the concerns raised in chapter four but the attention is shifted to the aggregate domestic price inflation. Firstly, the extent of pass-through in the short and long runs are estimated for the entire sample period using quarterly macroeconomic data. Secondly, the extent of pass-through is assessed using

annual data also. Thirdly, the stability of the price impact from currency variations are studied using the rolling regression approach and the Time-Varying Coefficients (TVC) framework. Lastly, the dynamic relationships between exchange rate, wholesale price inflation, consumer price inflation and real output growth are examined within a Structural Vector Auto Regression (SVAR) model.

Chapter six drives attention to the issue of directional, size and composite asymmetries in the behaviour of ERPT to both the aggregate import price inflation and domestic price inflation in India. The core baseline models from chapters four and five are tested for the existence of nonlinearity and thereafter each of the three types of asymmetries – namely the directional, size and composite, are evaluated using dummy variables approach and the 'polynomials term' approach. The results are examined and contrasted with the extant literature and new insights are unearthed with regards to the nature of asymmetry and nonlinearity in the pass-through relationship at the aggregate level. Lastly, chapter seven provides a summarizing perspective on the key findings, their interconnections, the limitations and constraints faced in this work and drives home some important policy implications.

Notes

[1] Under the pegged exchange rate regime, the currency value was tied in nominal terms to a set of currencies of the key trading partners with a pre-specified tolerable band. This changed when the payments crisis surfaced and India was forced to recalibrate its stance on exchange rate management. The system of dual exchange rate persisted for a short span following the devaluation of rupee. From April 1993, the LERMS was fully adopted, doing away with the collusive practices of authorized dealers who set the offered exchange rate at a markup over the reference rate (Acharya, 2013). A more detailed account on this aspect can be located in Dua and Ranjan (2010).

[2] One may confirm this observation with the fact that the depreciation of the rupee against the US dollar and other major currencies has continued consistently while the RBI has been utilizing its reserves to manage the volatility in the rate.

[3] Irrespective of the exchange rate regime, impulses generated by the exchange rate are expected to induce counter-adjustments in domestic markets. This can occur because under relatively rigid exchange rate regimes, such as a hard peg, forex reserves of the central bank would possibly transmit the external sector imbalances to local economic conditions.

[4] Bianchi and Coulibay (2023) provide an interesting perspective on the fears of floating exchange rate regimes. While the general belief tilts towards inflationary threats of floating exchange rate movements, contraction in output and deflation are also possible under certain conditions as shown by the authors. Another relevant reference on this issue is Baqueiro et al. (2003).

[5] In pass-through analysis of any variables, for illustration oil prices, the general empirical approach is to assume the variable which is expected to generate shocks as exogenous. A newer strand of literature within the pass-through analysis has also looked at the endogenous nature of the changes in a variable under consideration. Such frameworks generally adopt either a two-way causality approach or enter into the realm of simultaneous equation framework. With reference to the ERPT literature, please refer Aron et al. (2014) for a survey of works adopting different approaches in this regard.

[6] While the theoretical idea of pass-through effects of exchange rate changes pertain to the level of import and domestic prices, the actual estimation of ERPT occurs in terms of the first differential of price levels due to the lack of aggregate price level data and the need to use price indexes instead. This is an important matter because this changes the nature, specification and interpretation of the pass-through coefficients, which form the key subject matter in this context. The implications of deviations from the Law of One Price for macroeconomic management can be located in Monacelli (2003) and more recently in Lopez-Villavicencio and Mignon (2016).

[7] The term 'domestic prices' connotes the entire pricing chain ranging from wholesale prices to the retail level prices. Increasingly, the pass-through analysis has paid attention to the differences in degree of price impacts of exchange rate changes at different stages in the pricing chain. The general consensus in the Indian context appears to be that the extent of pass-through falls across the pricing chain.

[8] One may note that the edifice of the classical school in macroeconomics and its various extensions in the monetarist, new classical and other extensions require wage-price flexibility assumption to hold, at least in the long run. The pass-through analysis has found persistent incomplete transmission of exchange rate changes to trade and domestic prices even in the long run. This empirical observation cannot be easily reconciled with the classical framework. Hence, there has been a spurt of ideas in the domain of new open economy macro models that account for explanations of incomplete pass-through such as those based on the PTM models.

[9] One must be careful not to confuse Taylor's hypothesis in the pass-through literature with the Taylor's rule ascribed to Taylor (1993) which is a monetary policy interest rate forecasting approach.

[10] As highlighted in the chapter two, there have been studies that found complete or even higher than unity ERPT for aggregate imports in India. However, consensus is much more homogenous on account of domestic price pass-through.

[11] In case of a single commodity, pass-through analyst is focused upon the violations of the law of one price while within the macroeconomic approach, the analyst shifts attention to the violations of purchasing power parity.

[12] The idea of 'mark-up' within this approach relies on the non-normal profits that imperfectly competitive firms can enjoy due to market segmentation or other sources of monopolistic powers. This component of the pricing equation of such an exporting firm represents the absorption capacity of exporting firms to withhold exchange rate changes from transmitting to the importing nation.

[13] The primary framework governing the statistical machinery in India is the Collection of Statistics Act, 2008 which defines, structures and delineates each component of the official data assimilation system in India pertaining to socio-economic information. The Coordination and Publications Division (CAP) of the CSO is responsible for administering this act in the country. Macroeconomic data availability in India is directed by the "National Policy on Dissemination of Statistical Data" of MoSPI, Government of India. The data to be employed in this study are classified under the Category A data, i.e. information which is available publicly free of cost.

[14] The CPI-IW manual defines a working class family as "a family which is situated within the (sample) center, has at least one member working as manual worker in an establishment in any of the sectors covered, derives 50% or more of its income during the calendar month preceding the day of enquiry through manual work". The price structure captured by this variable is thus biased towards a particular section of the

economic classes and this caution must be kept in mind while interpreting the pass-through analysis results while employing this proxy for consumer inflation.

[15] As per the Labour Bureau, it has conducted such surveys in the past during 1958-59, 1981-82 and 1999-2000. The latest survey was from January to December 2016. This survey is based on the questionnaire method and is conducted by the NSSO.