EXCHANGE RATE PASS THROUGH IN INDIA

A
Thesis Submitted to
Department of Business Economics,
Faculty of Commerce,
The Maharaja Sayajirao University of Baroda
For the Award of the Degree Of
Doctor of Philosophy
In
Business Economics

May 2023

Research Scholar
Mr. Baria Bhagirath Prakash
(Registration No.: FoC/278)

Research Guide
Dr. K. Shanmugan
Associate Professor
Department of Business Economics
Faculty of Commerce
The Maharaja Sayajirao University of Baroda

Executive Summary

For Ph.D. Thesis titled

"EXCHANGE RATE PASS THROUGH IN INDIA"

Name of the Candidate : Baria Bhagirath Prakash

Registration Number : FOC/278

Registration Date : 17-07-2015

TABLE OF CONTENT

Ph.D. Thesis

TABLE OF CONTENT

Executive Summary

1. Research Methodology

1.1. Exchange Rate Pass Through to Import and Domestic Prices

Chapters 4 and 5 examine the issue of exchange rate pass-through to import and domestic prices respectively in India. Exchange rate pass-through to import and domestic prices have been active areas of debate in the international domain, with a particularly large number of studies studying the PTM behavior of exporters involved in trade among the Global-North countries. The relative dominance of advanced economies in the literature resulted in strong empirical presuppositions on how the ERPT coefficient should behave even for emerging nations, and the major factors that could explain the observed behavior of pass-through relationship. The early traces of active research on the pass-through issue can be traced to the observation of Japanese firms practicing differential pricing strategies which ignited the interest in import price pass-through (Feenstra, 1987; Marston, 1989; Feenstra et al. 1993). The shift from advanced economies to emerging economies began in the early 2000s when panel data-based studies began incorporating emerging economies into their samples and examined how pass-through dynamics underwent a change when attention was shifted from the advanced large open economies to emerging small open economies. The incompleteness of pass-through to import prices in advanced economies was largely justified by Taylor's hypothesis proposed by Taylor (2000) which also marked the beginning of an active macroeconomic approach to pass-through analysis. The findings from advanced economies served as a benchmark to build the expected inferences from emerging economies. Given that large open economies experienced incomplete pass-through, the emerging small economies should experience complete or even more-than-complete pass-through, at least to the trade prices. The findings from emerging economies largely testified to this notion though some discrepancies were found but were later rationalized using Taylor's hypothesis.

Pass-through analysis for emerging economies raised fresh new hypotheses that required further examination and this warranted the need for high-quality long-run time series data which posed a serious challenge in these economies (Aron et al., 2014). Thus, the methodological apparatus that was so well-suited for samples using data from advanced economies could not be simply 'extended' to emerging economies. Innovations in econometric methodologies were needed that could handle the data constraints in emerging economies while allowing robust inferences. There are different methods that have been employed across studies that use different samples with heterogeneous data sources. While there can be different ways of categorizing these methods, the framework of Aron et al.

(2014) can be useful at this point. Econometric methodologies in the import price pass-through analysis can be categorized into two major approaches: the first is the methods that use the single equation models where an import price function can be estimated through the new open economy macro models, such as the one found in Obstfeld (2002), or from partial adjustment models such as the one used in Webber (1999), or perhaps from reduced form equations of a simultaneous equation system such as the one proposed by Goldberg and Hellerstein (2008). These methods have proven to be powerful tools in exploring the nature of pass-through to trade prices while maintaining parsimony of variables, data, and econometric inferences. A key advantage of these methods is their ability to handle several nested hypotheses on the factors affecting the pass-through relationship while being suitable for samples with lower degrees of freedom. The fundamental feature of these models is that they "are based on reduced-form regressions from a partial equilibrium model" (Aron et al., 2014, pp. 121), and treat the changes in exchange rate variables as exogenous shocks. A major limitation of this approach is that structural breaks or changes including regime shifts can cause challenges in estimation and thus it is necessary to establish if such issues exist before estimation, and if they do, appropriate treatment should be adopted to avoid specification errors. Another concern with this method is that it warrants the use of stationary variables which implies differencing and possible loss of long-run information.

Given the concerns with the first set of methods, the second approach has emerged to estimating pass-through which is broadly termed as the systems approach which, in the context of import price pass-through, includes the VAR approaches and the DSGE models in the tradition of the new open economy approach to pass-through analysis. VAR models are capable of tracing the dynamic path of import prices following an exogenous shock in the exchange rate and can also handle the feedback effects. VECM approach is another frequently employed approach and these methods have provided may useful insights into the dynamics of import price behavior regarding exchange rate variations. Rajan and Yanamandra (2015) are an application of these methods in the Indian context during recent times. The DSGE model has not been explored actively in the area of import price pass-through in India but has been applied in several studies focusing on the pass-through to domestic inflation. Systems methods are capable of handling the endogeneity of exchange rate shocks which is not feasible with the single equation approach. However, one needs to justify theoretically in advance if the observed exchange rate variations are purely exogenous or emerge from the pass-through process itself. Such concerns, it seems, are generally not

examined before the time-series methods are employed in the pass-through analysis. An important advantage of the single equation models is their ability to accommodate varying theoretical models of pass-through mechanisms, thereby allowing structural estimation of the pass-through coefficient.

Given this brief background, the methodological choices in this study are driven by the following concerns: first, data constraints are a serious concern as far as the import price variable is concerned. As explained earlier, the variable used in proxying import prices is the Import Unit Value index whose data on monthly basis is available only from April 2013 onwards. The old Fisher index based on the year 1999-2000 is unavailable from the Directorate General of Commercial Intelligence and Statistics (DGCIS). Thus, one is faced with two choices: the first is to opt for the Import Price Index of the International Monetary Fund (IMF), or the second is to center the analysis on Annual data for which consistent and continuous time series on import unit value index are available. The data of the import price index for India by the IMF are problematic as their coverage, weighting pattern and construction methodology do not seem to represent the imports market of India and thus could provide a biased picture of the price variations in aggregate imports if used in pass-through estimation[i]. Thus, the decision was made to examine pass-through issues in the domain of annual data to incorporate continuous, consistent, and reliable time series information. However, the issue of short-run versus long-run pass-through necessitates monthly data as the definition of short and long runs have largely been captured in terms of months needed for the complete pass-over of exchange rate shocks into the aggregate import prices in local currency. Thus, the use of annual data implies that the instantaneous impact of exchange rate variations on import price inflation may very well be a composite coefficient incorporating the short-run impact, conceptualized as the coefficient in the first month, and the long-run impact, conceptualized by the coefficients from the second to the twelfth month. It is difficult to rationalize the pass-through effects beyond the twelve-month horizon and literature too has not been able to find much evidence of a strong degree of import price pass-through after twelve months have passed since the exchange rate shock. Thus, the current period pass-through coefficient in the estimations to be examined shortly, should correctly be interpreted as a composite pass-through coefficient incorporating both the immediate and lagged response of import prices to exchange rate changes.

Hence, this study employs a single equation approach by incorporating the features of the ERPT process in a partial equilibrium reduced form approach derived from the pricing

behavior of foreign countries supplying India's bulk of imports within the mark-up model for a small open economy. As documented earlier, the theoretical framework adopted in this study can be traced to the seminal works of Dornbusch (1987), Campa and Goldberg (2005), Bussiere (2013), Rajan and Yanamandra (2013), and Aron et al. (2014). Firstly, the estimation of the import price pass-through coefficient is undertaken using the baseline model as delineated in the previous sections. Each of the variables in the baseline model emerges from the underlying macroeconomic model developed earlier. Due care is taken to specify the model as parsimoniously as feasible. The estimation of the baseline model is undertaken using a partial equilibrium framework with Ordinary Least Squares (OLS) after duly ensuring that the time-series information is suitable for being captured via the OLS route. The strength of this econometric framework is its simplicity and ability for direct economic interpretation of the coefficients. The baseline model represents the core structure of the pass-through mechanism that is tested in this chapter. The primary concern is with how costs, mark-ups, and exchange rates together shape the import price function and how the import price pass-through coefficient has behaved during the sample period. The disaggregated feedback mechanisms that might be at work are presumed under the ceteris paribus condition. This is inevitable given that the fundamental concern of this chapter is to capture the aggregate relationships between different prices. The baseline model provides the basis for further estimations and all other estimations are specified around this baseline equation and are reported in section 5.1.

After estimating the import price pass-through coefficient in the baseline model, the analysis is expanded to account for additional macroeconomic variables that are strongly considered as possible determinants of the import price inflation itself. Incorporating these factors into the import price function helps to examine the pass-through coefficient while controlling for additional variables and thus the estimate of the pass-through coefficient is further refined. Key hypotheses on the determinants of import price inflation are tested in this expanded model reported in section 5.2. The analysis is undertaken within the partial adjustment framework on the lines developed by Koyck (1954) and Nerlove (1958). The lagged impact of import prices, the dependent variable, is incorporated into the baseline model with additional factors other than the factors accounted for in the baseline model. A stock adjustment, or the partial adjustment model, postulates a long-run equilibrium relationship and derives its short-run counterpart by allowing the dependent variable to adjust to its past values, which is generally presumed to be incomplete due to nominal or real

rigidities, “inertia, contractual obligations” (Gujarati and Porter, 2008, pp. 632), including contractual rigidities in the price setting due to menu costs, switching costs or other such factors. The advantage of the partial adjustment model is its ability to account for adaptive expectations in the determination of import price inflation and its ability to provide estimates for both the short-run and the long-run impacts of exchange rate variations on import price inflation. This is undertaken in section 5.2.

After undertaking the estimation of the determinants of import price inflation while refining the estimate of the pass-through coefficient, the issue of the factors shaping the behavior of the import price pass-through coefficient is examined. There are at least three approaches to this matter. The first approach is to estimate a time-varying coefficient of pass-through using methods such as the Kalman filter, a Time-Varying VAR model, or a linear Time-Varying Coefficient model such as the one adopted in this chapter later on. This time-varying coefficient can serve as a dependent variable to capture the variables that may impact the pass-through coefficient in an OLS framework.

The second approach to this issue is to employ interaction terms between the exchange rate and the possible determinants of the pass-through coefficient itself. One can locate this approach in Goldfajn and Werlang (2000), and in the Indian context in Patra et al. (2018) in recent times. The idea behind using interaction terms in the import price function itself is that the coefficient of the interaction terms would reflect the extent to which the additional information of the determinant factor inflates or deflates the impact of exchange rate variations on import prices. While pass-through is defined in terms of the unilateral effects of exchange rate variables on import prices within the import price function, an interaction term would imply the extent to which the interacting factor can increase or decrease the impact of exchange rate on import prices. A high and positive coefficient would imply that the factor being interacted with the exchange rate is enabling a larger pass-through of exchange rate changes to import prices and in case of a high but negative coefficient, vice versa. The coefficients of the interaction terms may be interpreted as modified ERPT coefficients which signify the combined impact of the exchange rate and the hypothesized determinant rather than the unilateral impact of the exchange rate on import prices.

The third approach possible in this regard is to build a dependent variable through the ratio of import price changes to exchange rate changes and utilize it to model the possible determinants of the ERPT coefficient. Put simply, the ERPT coefficient is defined as the

average effect of exchange rate variations on import prices without controlling for other possible intermediating factors. Theoretically, pass-through is an elasticity coefficient derived after the impact of other intermediating factors is controlled for within a regression framework. Using a simple ratio would bias the nature of the pass-through coefficient and such a variable ceases to be a coefficient in the first place. Hence, this chapter undertakes the analysis on this account by using both the first and the second approaches and is perhaps the first study to investigate the issue of import price pass-through at such an analytical depth[ii]. Thus, in section 5.3, the relationship between exchange rate variations and various macroeconomic factors affecting the import price pass-through coefficient is investigated while expanding the scope of the models estimated in the previous sub-sections.

Lastly, a fundamental concern in the macroeconomic analysis is the temporal stability of the structural relationship hypothesized in a linear[iii] model. A voluminous literature has emerged on this issue following the classic critique of aggregative macro models expounded by Lucas (1976) who criticized the "stable-parameter view" of macroeconometric research and raised the concern that the very causal relationships between aggregate variables being captured by econometric models may be time-variant, thereby causing the underlying relationship itself to shift across time. Such a 'changing-structure' view caused an uproar among macroeconomists and empirical studies began testing the Lucas Critique on different issues such as monetary policy, trade balance adjustments, growth models, and also the matter of ERPT. Macroeconomists have been very much open to the prescriptive implications of the Lucas Critique – a sound macroeconomic model must ensure that the structural parameters of the model are broadly stable across time so that the inferences can be applied to the entire sample period and possibly utilize the estimated model for forecasting (Goutsmedt et al., 2015). In other words, the identification of the true model must account for the temporal behavior of the underlying economic model (Sims, 1980). However, the empirical prescription that policy changes can cause the true parameters to change following the policy change has been put to test and the evidence has been at best mixed (Linde, 2001).

The hypothesis of a time-variant versus a time-invariant ERPT coefficient is examined in this chapter by using a Time-Varying Coefficient (TVC) model that allows the estimation of a time-varying ERPT coefficient within the linear framework itself. The model is developed in the works of Schlicht (2020), Schlicht (2021), and thereafter in Schlicht (2022). There are several other approaches in this perspective, such as the use of the Kalman filtering technique as applied in Pizzinga (2012), other state-space models, non-linear time-

varying models, Flexible Least Squares-based models such as the one proposed in Kalaba and Tesfatsion (1989) and the framework adopted in this study. Across all these approaches, the most suitable time-varying model should be able to accommodate a linearly specified model while posing lesser data requirements and more robust inferences.

A time-varying parametric model must estimate the time path of an economic relationship using the sample information by calibrating its expected behavior through some kind of iteration. Some approaches use bootstrapping, while others use recursive methods. The Schlicht (2021) framework estimates a 'method of moments' estimator within the state-space model where coefficients are presumed to be generated by a random walk process. The time-variant estimates for the coefficient of interest are estimated as conditional expectations of the coefficients given the sample data. Thereafter the time-average estimates of the coefficient for each point in time are estimated via the Generalised Least Squares (GLS) estimates of the corresponding regression with time-invariant coefficients. This method has various strengths against the other alternatives mentioned above. First, this approach does not warrant initial values for the initial state and the initial variances but estimates endogenously. This may be considered as its strength against the Kalman filter approach (Schlicht, 2021). Second, given that the estimates are based on the 'method of moments', the assumption of Gaussian disturbances is not imposed *a priori*. Third, this method allows the analyst to vary only one coefficient or multiple coefficients across time, thereby allowing the testing of a range of economic models where not all coefficients may be time-variant. Thus structural modeling of a wide variety of economic theories can be undertaken in this approach. Fourth, the fundamental property of this approach is the selection of estimates that minimize the sum of squared disturbances in the specified equation and a weighted sum of squared disturbances in the coefficients where the weights are estimated as the inverse of the variance ratios estimated by the algorithm. This allows the algorithm to balance between the goodness of fit and parameter stability simultaneously.

The most important limitation of this approach is the assumption of the coefficients being generated by a random walk process and more general stochastic processes are not considered in this algorithm. However, the assumption of coefficients being generated by a random walk process may not be completely unrealistic with regards to the ERPT coefficient and this assumption can serve as a working assumption to derive the time-varying estimates rather than as a theoretical imposition on the underlying Data Generating Process (DGP). Moreover, the strengths of this approach far outweighs its limitation and thus this chapter

employs the Schlicht (2021) time-varying coefficient approach to estimate the ERPT coefficient across the period 1991-92 to 2021-22. After estimating the same, the chapter examines the time-series properties of the estimated coefficient while comparing it to the alternative estimates which were arrived at by using a Rolling Regression approach. The rolling regression coefficient estimates are contrasted to the time-variant estimates of the ERPT coefficient and inferences are drawn on the nature of the pass-through process in India pertaining to import prices. The analysis is not constrained only to the estimation of the study of the stability of the pass-through coefficient but the determinants of the stability or instability in the pass-through coefficient as investigated by testing hypotheses that are supported by both the underlying theory and the literature. Thereafter, chapters four and five are concluded.

1.2. Dynamic impact of exchange rate variations on domestic inflation

The use of single equation partial equilibrium models in the previous sections provide evidence on the incompleteness of pass-through in both the short-run and long-run. Despite testing variations of the baseline models, pass-through to domestic prices remained incomplete and low. Furthermore, stability analysis revealed that the price impact of exchange rate has been highly stable, indicating a largely time-invariant behavior across the sample period. It was also located that inflation is primarily determined by monetary policy, its inertia and exchange rate variations. Within the parsimonious perspective laid in earlier sections, external sector has played a critical role in shaping the path of inflation in India since the reforms.

However, there are some concerns that single equation models are not capable of adequately handling. First, the feedback effects embodied among the interrelations between macroeconomic variables is largely suppressed by single-equation models, whose primary work on the ‘ceteris paribus’ assumption. Exchange rate variations impact domestic prices, but the nature of this impact is different when looked from a single-equation partial equilibrium approach versus when allowance is made for interactions and feedbacks among both the variables. While the theoretically ‘pure’ impact is provided through the single equation models, it is equally important to understand how both would interact if they were permitted to contemporaneously impact each other along with more other macroeconomic variables. Such an impact from exchange rate on domestic prices would reflect a more realistic assessment of pass-through relation that corresponds to how actual markets and

economies interact. Second, the 'ceteris paribus' assumption cannot be relaxed when employing the single-equation approach. Hence, more flexible approaches are required to handle this requirement.

Third, feedback effects can change the nature of pass-through process drastically and such a perspective cannot be obtained from the traditional econometric approaches. Fourth, the true nature of 'dynamism' in the pass-through relationship cannot be captured solely by the lagged terms of either the inflation or exchange rate. The dynamic relationship between them may be further shaped by interactions within and across other macroeconomic variables. Such an analysis is not feasible in the traditional frameworks. Fifth, each movement in exchange rate variable is treated as exogenous in the single equation models. The important distinction between 'change' and 'shock' is generally overlooked by traditional models, as discussed below. Sixth, the problem of endogeneity of exchange rate in the inflation determination process may cast doubts on the single equation inferences. Seventh, the extent to which exchange rate impulses are transmitted throughout the pricing chain, starting from import prices up to the retail prices, cannot be estimated within the single equation frameworks.

Thus, alternative perspectives are required to address these concerns. At least two approaches are present that can address these issue coherently. First, is the simultaneous equations approach, while second is the Vector Auto Regressive (VAR) models. These approach can handle the major issues highlighted above while providing richer estimates of the ERPT coefficient. Before the advent of the Vector Auto Regressive methods laid by Sims (1980), the simultaneous equations approach was perhaps the dominant approach to address the above concerns. However, there were certain concerns raised in the use of multivariate simultaneous equations approach. The fundamental apprehension was on the subjective and ad-hoc nature of assumptions regarding the exogeneity of variables in the simultaneous equations structure. The critique of macroeconomic models contained in Tinbergen (1939) and Lucas (1976) provided the opportunity to reflect on the foundations on which the macroeconomic empirical exercises were undertaken. While the theoretical criticisms of large scale macroeconomic models were laid in the works of Lucas (1976), the econometric alternative was provided by Sims (1980) who proposed the VAR approach to macroeconomic empirics.

A fundamental criticism of the simultaneous equations approach made by Sims (1980) was that the classification of variables into endogenous and exogenous was not always founded in sound economic theory (Hashimzade and Thornton, 2013). The VAR approach provided by Sims and developed by a large volume of literature later, allows a more data-centric approach where all the variables of a model are assumed to be a-priori endogenous. This framework permits the examination of dynamic nature of ERPT relationship through incorporating of not only contemporaneous but also lagged relationships among the variables into a unified system of equations that are individually estimated using the OLS. Hence, VARs provide a superior alternative to the traditional OLS system by incorporating a much more dynamic, interconnected and complex structure of macroeconomic relationships, while utilizing the strengths of the least squares approach.

The primary challenge in using VAR is identifying structural shocks from the residuals of the modelled equations (Enders, 2014). This issue arises because the estimated VAR will represent the reduced-form equation while the structural shocks in which one is interested are based on the underlying "primitive system" (Enders, 2014, pp. 292). Recovering the information about the primitive system from the observed results is the identification problem in VAR models. Identification is achieved by imposing restrictions on the relationships between the endogenous variables in a manner that structural shocks can be obtained, or worked back, from the reduced-form VAR. Literature has provided different approaches to imposing the restrictions which are generally known as 'identifying restrictions'. The most frequently employed identifying restriction is the Cholesky method that decomposes residuals of the estimated OLS-based model using either a lower triangular or an upper triangular matrix of contemporaneous relations between the endogenous variables in the system. The Cholesky factorization method is flexible and capable of handling positive definite matrices, where it provides a unique solution, and indefinite matrices where some solutions may exist (Lütkepohl, 2005; Higham, 2009). This approach has been perhaps the most frequently employed method of identifying structural shocks and estimate the impulse responses in the pass-through literature.

Several analysts raised that concern that imposing a Cholesky structure on contemporaneous relations needs to emerge from theory rather than statistical necessities (Hashimzade and Thornton, 2013). In other words, the restrictions imposed by the Cholesky approach should have sound economic logic; otherwise the impulse responses and variance decompositions will be unreliable. Moreover, the Cholesky approach is limited to triangular

decomposition and thus does not permit other approaches (Saha and Zang, 2013; Lindfield and Penny, 2019). It is plausible that economic theory might demand other forms of restrictions that do not rely on a triangular formulation of the matrix of contemporaneous coefficients or the variance-covariance matrix. Illustrations of such restrictions may be seen in the cases where sign restrictions are needed, or long-run restrictions are to be imposed such as what is done in the Blanchard-Quah decomposition method contained. Furthermore, the Cholesky method is highly sensitive to the ordering of variables and restricts the role of theory to deciding the ordering of variables (Lütkepohl, 2005; Enders, 2014). Enders (2014, pp. 313) notes that "unless the underlying structural model can be identified from the reduced-form VAR model, the innovations in a Choleski decomposition do not have a direct economic interpretation". The wedge between the VAR estimates and economic theory may not pose a large danger to the forecaster, but can have serious implications for an analyst interested in explaining macroeconomic processes such as the ERPT mechanism[iv].

Hence, other approaches have been proposed in the literature to synthesize economic theory in a richer manner with the empirical finesse of the VAR models. One such approach is provided by the Structural VAR (SVAR) models. This model provides the ability to fully identify the structural shocks such that the identified shocks are directly in consonance with an economic model. If forecasting is the only aim, then the forecast errors of the estimated VAR model, which are observable are useful in themselves and their source may not be important. However, when the interest lies in economic analysis, i.e. when one wants to estimate the impulse responses and variance decompositions, identifying the structural shocks is necessary and forecast errors are not sufficient. SVAR utilizes "economic theory (rather than Choleski decomposition) to recover structural innovations from the residuals" (Enders, 2014, pp. 314) of the observed or the estimated VAR model. However, the restrictions cannot be made haphazardly, but must ensure that the structural shocks are recovered from the forecast errors and the independence of the shocks is maintained (Lütkepohl, 2005; Enders, 2014). In order to locate the structural model from the estimated VAR system, imposition of $(n^2-n)/2$ restrictions are required. Hence, with a VAR having 4 endogenous variables, as adopted in this chapter, at least six restrictions are necessitated to just-identify the structural model. If the number of restrictions are lesser than this, the model will not be identifiable. If it is more than this, the SVAR system will be over-identified. The identification of the structural shocks requires information on the estimated matrix of contemporaneous coefficients as well as the estimated variance-covariance matrix.

An important motivation in employing the VAR framework is to recognize the differences between impacts of shocks versus the changes in exchange rate on domestic prices. An economic shock is different than an economic change. Changes in exchange rate may occur regularly in a defined or an undefined fashion but are a result of the regular trading activities in the international foreign exchange rate market. Such movements are generally predictable or if not predictable, are at least expected by economic agents and hence form a part of the price discovery process. Shocks on the other hand are largely unexpected, sudden and unpredictable. There is no a-priori mechanism to account for shocks and this is what lends such variations the connotation of a shock. Single equation models tend to treat all changes as shocks, while the VAR system identifies them after accounting for the interrelations and feedbacks among the endogenous variables. Moreover, an exchange rate shock needs to be of a sizeable nature to induce relevant economic adjustments in domestic prices. This dimension can be handled by the VAR approach. Particularly, the SVAR model can allow identification of shocks that are theoretically plausible and provide economic information rather than purely statistical information. Unlike traditional VARs, the SVAR is capable of synthesizing economic theory through plausible restrictions on the relationships estimated by an unrestricted VAR[v]. This permits the construction of economic shocks whose time-paths and effects on other variables in the system can be traced to a theoretically sound macroeconomic process[vi].

1.2.1. Underlying Theoretical model

This chapter explores the dynamic relationship between exchange rate, wholesale price inflation, consumer price inflation and real output growth for the period 1991-92 to 2021-22 using quarterly data with key exogenous variables and economic restrictions that help identify the structural shocks from the estimated residuals. An important pre-condition to utilize VAR models is to employ stationary variables. While not all analysts, including Sims himself, agree with the need to use only stationary variables, it is generally expected that stationary variables will be able to better capture the underlying data generating process and their use will help to estimate a stable VAR system. The stability of the VAR system is critical to ensure that the economic inferences are valid and generalizable. The variables employed in the SVAR framework, both the endogenous and exogenous, are used in stationary form[vii].

As stated above, four endogenous variables are utilized for the analysis. The first variable is the exchange rate variable, measured by the log difference of the nominal effective index. The second variable is the wholesale price inflation, measured by the log difference of WPI. The third variable is the consumer price inflation measured by the log difference of CPI. The fourth variable is the real output growth rate, measured by the log difference of the real GDP. All the variables are employed in the first difference of logarithmic values, i.e. in the log difference form, to ensure stationarity of the variables. Inclusion of wholesale and consumer inflations into the single VAR system together is to changes in pass-through in the aggregate pricing chain. Literature has generally found that the inflationary impulses of emanating from exchange rate shocks reduce as one moves from import prices to the consumer prices. Ideally, import price variable should also be included, but the data are missing for quarterly and also monthly levels for the entire sample period. Moreover, it is the import price variable that is necessitated rather than import unit value index. Given these constraints, the import price variable is not included[viii]. However, studies in the Indian context have more frequently employed the CPI instead of the WPI when estimating the VAR models and have largely found higher pass-through to CPI than when the WPI is used.

The VAR system is conceptualized to allow the exchange rate impulses propagate through the price channel and culminate into real impact ensuring the logical completion of the ERPT process. The use of real output growth as the last variable in the system is different than other studies in Indian context who generally model output gap or real output growth as endogenous variables in the VAR system such as done in Ranadive and Burange (2015), Mendali and Das (2017) or Patra et al. (2018) in recent times. Macroeconomic theory, whether one looks from the Classical or the Keynesian perspectives, theorize price impacts as culminating into real impacts for meaningful economic impact to occur. Pure price relationships, without culmination into quantity impacts, would tend to suggest a mechanism that does not produce any change in actual economic decisions of agents. In other words, without allowing price changes to induce real impacts, the price relationships captured by the ERPT process would not lend themselves useful for economic analysis and policy formulation. The final aim of economic processes is to cause actual behavioral changes, and pure price relationships would not allow for such changes, thereby would not generate information that may be useful for either policy or economic analysis. Motivated by these observations, the real output variable is utilized as the final culmination of the inflationary impulses from exchange rate into the domestic economic structure.

While the endogenous variables shape the core equations of the VAR system and will provide the fundamental relationships which are to be modelled into an interrelated dynamic pass-through process, there are variables that may not be a part of the system itself but may still play a pivotal role in shaping the behavior of the system. Such variables are the exogenous variables that are considered to be 'outside' the system of interrelationships captured by the SVAR model, but are nevertheless critical for properly capturing the pass-through mechanism. While several studies in the Indian context have endogenized several of these variables, the choice appears to have either been ad-hoc or undertaken within a lower triangular matrix, thereby broadly treating the initial variables of the system as exogenous. One important variable in this context is the oil price variable, which has been frequently utilized as an endogenous variable in the VAR system such as undertaken in Ranadive and Burange (2015), Mendali and Das (2017), and Patra et al. (2018). However, it is difficult to rationalize the oil price movements as emerging from the pass-through mechanism itself. Oil price formulation is a much more complex phenomenon that is captured by several international and global factors and endogenizing this variable into the pass-through VAR system would perhaps not do justice to the complexities of the oil markets and the price discovery process in these markets[ix]. Hence, oil price inflation is treated as the first exogenous variable in the SVAR system.

The second exogenous variable in the structural VAR system is the monetary policy variable, measured by the log difference of the real money supply. The use of real money supply, i.e. nominal M3 deflated by WPI was undertaken to avoid the non-stationarity problem of the nominal money supply variable encountered in this study. The nominal broad money variable remained non-stationary despite first differencing and attempting different transformations such as its year-on-year quarterly growth rate as well as other formulations. Money supply is a critical factor impacting the pass-through mechanism and ignoring it due to econometric issues could not be justified on theoretical basis. Given its conceptual importance in the issue under investigation, the nominal brad money variable was deflated by wholesale price index to obtain the real money supply variable, which represents the purchasing power of given stock of money. This variable is employed as a proxy for monetary policy variable and is stationary in log difference form.

The third and fourth exogenous variables are dummy variables representing the monetary policy regime change in October 2016 when Flexible Inflation Targeting (FIT) was introduced and another dummy variable representing the impact of the pandemic on output

and inflation. Following Enders (2014), an intervention analysis approach is adopted and gradual intervention is permitted by specifying the dummy variables with values 0.25, 0.50, 0.75 and thereafter 1.00, up till the end of the sample period, to model their gradual incorporation by agents and the spread of their impact across the economy[x]. The rationale and nature of these two variables have already been elaborated in sections 5.3 and 5.7.1. These two variables have been used to proxy the important policy changes which could have impacted inflation and output behaviour.

Choice of lag length is another critical econometric dimension in the VAR analysis. There is a danger of overfitting a model and running into "degrees of freedom" problem (Khundrakpam and Jain, 2012). In case of underfitting the model, the estimates will be unreliable and the resultant impulse responses and variance decompositions might possess no economic or econometric meaning. Hence, using some forms of criteria to locate the correct lag length so as to avoid the problems of underfitting and overfitting is necessary. The information criteria are employed to "pare down" (Enders, 2014, pp. 290) to the correct lag length and this is accomplished by undertaking the lag length test for up to eight lags. The choice of the correct length is based on using the Akaike Information Criteria (AIC), Schwarz Information Criteria (SIC), and the Hannan-Quinn Information Criteria (HQIC). Among these three, reliance is made on the AIC given that it performs better in small-samples and thus has better small-sample properties compared to other criteria (Lütkepohl, 2005; Enders, 2014). Accordingly, the lag length is selected to be four in the present context.

Thus the VAR model contains four equations, each for the exchange rate, wholesale price inflation, consumer price inflation and real output growth. The reduced-form VAR can be stated as follows:

$$\mathbf{y_t = A_0 + A_1(y_{t-1}) + A_2(y_{t-2}) + A_3(y_{t-3}) + A_4(y_{t-4}) + C(x_t) + e_t} \quad \mathbf{....(12)}$$

Where, y_t is the vector of contemporaneous values of the four endogenous variables, A_0 is the 4-dimensional vector of intercepts, A_1 to A_4 are the 4*4 square matrices, C is the 5*4 matrix of coefficients of exogenous variables while x_t is the vector of exogenous variables, and ε_t is the 4 dimensional vector of current time-series values of the reduced-form innovations, and ε_t depicts a 4 * 1 white noise innovation process with expected value of zero, $E(e_t e_t') = \sum_e$, and $E(e_t e_s') = 0$ for all $t \neq s$. Hence, following is the structure of the VAR model in matrix form:

$$\begin{bmatrix} \Delta InNEER_t \\ \Delta InWPI_t \\ \Delta InCPI_t \\ \Delta InGDP_t \end{bmatrix} = A_0 + A_1 \begin{bmatrix} \Delta InNEER_{t-1} \\ \Delta InWPI_{t-1} \\ \Delta InCPI_{t-1} \\ \Delta InGDP_{t-1} \end{bmatrix} + A_2 \begin{bmatrix} \Delta InNEER_{t-2} \\ \Delta InWPI_{t-2} \\ \Delta InCPI_{t-2} \\ \Delta InGDP_{t-2} \end{bmatrix}$$

$$+ A_3 \begin{bmatrix} \Delta InNEER_{t-3} \\ \Delta InWPI_{t-3} \\ \Delta InCPI_{t-3} \\ \Delta InGDP_{t-3} \end{bmatrix} + A_4 \begin{bmatrix} \Delta InNEER_{t-4} \\ \Delta InWPI_{t-4} \\ \Delta InCPI_{t-4} \\ \Delta InGDP_{t-4} \end{bmatrix} + C^*x_t + \varepsilon_t$$

...(13)

1.2.2. Nature of restrictions and construction of the SVAR model

Table 2: Restrictions imposed on the reduced-form VAR for identifying the SVAR model

Sr. No.	Type of Restriction	Restriction
1	Contemporaneous restrictions (total restrictions = 06)	1. WPI does not have a contemporaneous impact on NEER. 2. CPI does not have a contemporaneous impact on WPI and NEER. 3. Output does not have a contemporaneous impact on CPI, WPI as well as NEER.
2	Short-run restrictions (total restrictions = 01)	4. Output does not impact NEER.
3	Long-run restrictions (total restrictions = 01)	5. NEER does not impact Output
4	Restrictions on Exogenous Variables (total restrictions = 04)	6. Oil prices do not impact the exchange rate but affect inflation (WPI and CPI), and output. 7. Money Supply growth impacts inflation and output but not the exchange rate. 8. The introduction of Flexible Inflation Targeting impacts inflation and output but not the exchange rate. 9. The lockdown impacts output and inflation but not the exchange rate.

Source: Author's specification.

The fundamental relationship through which the identification of the structural innovations is undertaken are contained in the relationship between the structural shocks and

errors from the reduced-from estimated VAR. The restrictions utilized for the SVAR estimation including the linear restrictions on exogenous variables are shown in Table 5.12.

The first set of restrictions are on contemporaneous relations between the endogenous variables. A unit lower triangular matrix is obtained through these restrictions. The rationale for not allowing each variable to impact the previous variables in the ordering is to recognize that the inflationary impulses from exchange rate shocks require time to generate feedback effects. Given that the analysis is aggregate in nature, the impact of exchange rate variations on domestic economy via the price channel will cause large number of adjustments in diverse markets that are themselves interconnected in a complex web of relations. Expecting, for instance, wholesale price inflation to immediately cause change in exchange rate will imply that the adjustments in wholesale markets are instantaneous. This seems to be improbable given that aggregate adjustments inherently involve lags and agents require time to absorb the inflationary impulses from exchange rate shocks. Similarly, CPI is not permitted to contemporaneously impact WPI to account for lags in adjustments at the retail level due to inflationary impulses from both the exchange rate and the wholesale markets. Wholesale markets are bulk markets and the agents trading in these markets tend to be more sensitive and reactive to inflationary impulses than are the retail consumers. The consumer market is far larger, wider and complex which implies larger amount of time in adjustments due to exchange rate shocks and the subsequent chain of events. Given that price impact from exchange rate will require time to spread across the large number of retail markets across the geographical spread of the country, it is plausible to expect that CPI inflation will not be able to immediately impact wholesale markets as adjustment is time consuming in the retail markets and price signals will not be generated instantaneously. However, WPI inflation will have immediate repercussions for consumer markets as important inputs, capital goods, essentials like crude oil and a host of other commodities are traded in wholesale markets whose price impulses will rapidly cause behavioral changes from consumers further down the supply chain.

CPI is also not permitted to impact NEER contemporaneously to recognize the fact that adjustments in consumption due to changes in prices from exchange rate variations will take time to accumulate at a level that can cause expenditure switching and thereby cause variations in the exchange rate. Output is also restricted in terms of its immediate impact on prices in the pass-through mechanism. Quantity adjustments require time and are generally slower than price variations which may happen not only due to real but more frequently due

to monetary and financial reasons. Exchange rate, for example, may vary sizeably due to changes in net capital inflows, causing an inflationary shock. Such changes are rapid in nature. These changes will tend to pass over into other price variables in the VAR system much more rapidly than would real impulses, such as an output shock. Quantity adjustments require time to unfold and accumulate to an extent that are sizeable enough to induce price reactions. While prices may react faster to each other and output in itself may react instantaneously to price variations, the reaction of prices to output variations will depend on the length of the real adjustment in the economy. Quantity or real adjustments require changes in the factor allocations, capacity utilization and other aspects that are not rapid but require sufficient time to uncover themselves. Hence, it seems much more plausible to conceptualize prices are rapidly reacting to each other and impacting output than theorizing output as inducing immediate price reactions, because the output adjustments are time consuming in the first place. Hence, output is constrained in its instantaneous impact on the prices in the VAR system.

However, in the short-run, quantity adjustments due to the initial exchange rate shock can induce variations in domestic prices. The feedback effects from changes in output growth could induce short-run impact on prices, given that some amount of time is available for quantity adjustments to accumulate and percolate through a large set of markets; though this process will still require time to unravel completely, which can occur only over longer horizons. Consistent with this belief, output is permitted to impact the domestic price variables but is not allowed to impact exchange rate in the shorter horizons. Exchange rate displays considerable volatility in the short-run and is driven by many non-quantity factors such as market sentiments, movements in derivate markets, global shocks and others. Domestic output variations will need to be sufficiently large to cause meaningful reactions from a volatile variable such as the exchange rate. Thus, it seems plausible that exchange rate is not impacted during short horizons by output variations. However, over the longer horizons, output variations may accumulate sufficient size and depth so as to cause changes in demand for imports and supply of exports on the trade side, and possibly causing changes in net capital inflows, which together could alter the exchange rate of the Indian rupee. Hence, in the long-run, output is permitted to impact the prices as well as the exchange rate. However, over longer horizons, exchange rate is not expected to strongly impact output variations, given that in the long-run the neutrality of money would set it, which could prevent temporary exchange rate shocks to cause changes in output. In the long run, output

variations are generally considered to be supply determined, and thus meaningful changes in output growth would occur largely by supply side policies and shocks rather than price shocks such as the exchange rate. Moreover, while domestic prices could still have impact on output and vice versa in the long run, the impact of the external channel on domestic output is expected to weaken over time. Long term output movements are more attuned to changes in domestic supply-side macroeconomic fundamentals that may not be strongly shaped by exchange rate variations once sufficient time is permitted for the pass-through effects to work out their full effects.

Lastly, linear restrictions are also introduced into the VAR system by constraining the possible impacts off the exogenous variables on the endogenous variables. The restrictions are driven by the understanding that not all exogenous variables in a VAR system can have meaningful implications for all endogenous variables. Oil prices are allowed to affect inflation and output but not the exchange rate. This is consistent with the literature in the Indian context where oil price is always ordered before exchange rate. As explained earlier, the oil markets are complex and the price discovery process cannot be associated with the exchange rate of a single currency such as the Indian rupee. Oil markets generally use the US Dollar or the currencies of the OPEC members and thus movements in Indian currency are not expected to bring any sizeable implications for the global crude oil price. It is also assumed that money supply does affect exchange rate but impacts inflation and output. Given that the RBI has left the exchange rate to market forces, monetary policy has assumed independence from exchange rate considerations and thus it is expected that monetary management will not be directed towards exchange rate management, consistent with the exchange rate regime adopted in India. The introduction of the FIT regime was geared towards better managing price stability and keeping inflation under tolerable limits. Inflation can generate impact on output, at least in the short-run, but the rationale of the FIT regime did not have exchange rate considerations. Hence, the dummy variable for FIT is assumed to not impact exchange rate. Lastly, the dummy representing the economic implications of the pandemic, primarily due to the series of necessary lockdowns, is not expected to affect exchange rate as it was largely a domestic event.

The set of restrictions contained in Table 5.12, are portrayed in matrix representations 14 to 17.

$$\begin{bmatrix} \varepsilon_t^{\Delta InNeer} \\ \varepsilon_t^{\Delta InWPI} \\ \varepsilon_t^{\Delta InCPI} \\ \varepsilon_t^{\Delta InGDP} \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 \\ a_{2,1} & 1 & 0 & 0 \\ a_{3,1} & a_{3,2} & 1 & 0 \\ a_{4,1} & a_{4,2} & a_{4,3} & 1 \end{bmatrix} * \begin{bmatrix} e_t^{\Delta InNeer} \\ e_t^{\Delta InWPI} \\ e_t^{\Delta InCPI} \\ e_t^{\Delta InGDP} \end{bmatrix} \quad \text{....(14)}$$

Representation 14 positions the identification of the structural innovation through the errors estimated from the reduced-from VAR system. Similarly, the variance-covariance matrix of the errors from the estimated VAR can be represented as shown in the representation 15. The co-variances are restricted to be zero so as to allow the identification of structural shocks associated with each of the variable under consideration. The consequent variance-covariance matrix is shown in the representation 15 as follows.

$$\begin{bmatrix} var(e_{1t}) & 0 & 0 & 0 \\ 0 & var(e_{2t}) & 0 & 0 \\ 0 & 0 & var(e_{3t}) & 0 \\ 0 & 0 & 0 & var(e_{4t}) \end{bmatrix} \quad \text{....(15)}$$

Where, e_{1t} is the error term of the equation for exchange rate variable, e_{2t} is the error term for the equation of WPI, e_{3t} is the error term for the equation of CPI, and e_{1t} is the error term of the equation for real output growth. Similarly, the short-run impulse response matrix is specified so as to restrict the effects of aggregate production on the value of currency to zero, while the long-run impulse response matrix is constrained by assuming the influence of exchange rate on output to be zero.

1.3. Directional and Size Asymmetries in Exchange Rate Pass Through to Import and Domestic Prices

The present study develops the methodological approach on the basis of Pollard and Coughlin (2004), Bussiere (2013), Aron et al. (2014), and Brun-Aguerre et al. (2014). The literature on asymmetric ERPT has provided several approaches to address the matter. While some approaches focus exclusively on addressing directional asymmetry, other approaches focus on size asymmetries. The first and a frequently employed methodological approach is to use dummy variables for capturing size, directional and composite asymmetries. In this

approach, one dummy variable is specified for each of the cases of appreciation, depreciation, small change, and large change. Hence, four dummy variables are specified which are valued as 'one' for the asymmetry of interest, and 'zero' otherwise. The issue of composite asymmetry is addressed by interacting these dummy variables to yield dummy variables for small appreciation, large appreciation, small depreciation and large depreciation. The present study adopts this method following Pollard and Coughlin (2004) and specifies relevant dummy variables for each type of asymmetry as narrated above. The advantage of this method, among others, is that it permits the extension of linear models and allows incorporating nonlinearities, i.e. asymmetries, into the linear framework itself. Hence, it is a parsimonious approach whose results have largely been verified by a large body of literature.

Increasingly, another approach that is gaining relevance in the pass-through literature is the use of non-linear econometric structure to capture asymmetries. Frameworks such as Nonlinear Auto Regressive Distributed Lag (NARDL) models, Non-linear Vector Auto Regressive (NVAR) models, Threshold Regression models, Switching Regression models, among some others, are being employed by the literature to capture asymmetries endogenously rather than imposing the asymmetric constraints exogenously as done in the dummy variables approach. Despite their complexities, not surprisingly enough, the evidence from non-linear models have largely corroborated the findings from linear dummy variables-based models of asymmetry. Adopting the principle of occam's razor, this study adopts the dummy variable approach to capture non-linear and asymmetric pass-through and shed some light on the nature of nonlinearity of pass-through in India.

The baseline models from the previous chapters are extended in this chapter to test the key hypotheses of asymmetric pass-through. Specifically, equation 13 in chapter four, and equations 5 and 6 from chapter five are utilized to account for direction, size and composite asymmetries. The variables, their sources and the econometric properties of those variables have already been elaborated in the respective chapters. Both the bilateral Rupee-US Dollar exchange rate and the NEER[xi] are used to specify the dummy variables, and given the largely similar picture emerging from both the cases, the results with NEER are reported in this chapter to maintain consistency and comparability with the previous chapters. The use of the 'dummy variables approach' requires specifying the nature of the dummy variables and the definition of the criteria used to specify them. The issue of directional asymmetry has been well-agreed upon in the Indian setting.

%∆NEER > 0: Appreciation ….(1)

%∆NEER < 0: Depreciation ….(2)

While there is complete agreement on the definition of appreciation and depreciation in exchange rate, larger debates have raged on the issue of defining the size of exchange rate changes. Literature has proposed several approaches to handle this matter. The first set of approaches are those that impose an exogenous definition of small and large exchange rate change. Pollard and Coughlin (2004), and Bussiere (2013), for example, define any change in exchange rate being more than 3% as large; otherwise it is defined as a small change. Other studies have used the standard deviation to define small and large changes. Rajan and Yanamandra (2015) is an illustration in this regard. A third approach in the Indian context has been to define any change above the mean change in exchange rate as large; otherwise it is specified as small. Yanamandra (2014) is an illustration of such an approach. Yet another framework has been to define any change larger than the median as large, or otherwise it is defined as small (Yanamandra, 2014). All these approaches are the exogenous approaches, wherein the size constraint is specified a-priori. There is another approach on this issue which locates the size constraint endogenously from the exchange rate variable itself. Such approaches suggest that the 'threshold' to differentiate the small and large changes should emerge from the exchange rate movements themselves. Threshold regression models and NARDL models are employed to locate this threshold and estimate separate pass-through coefficients for small and large changes. Some problems with these approaches include their complexity, larger data requirements and difficulties in capturing the composite asymmetry. Furthermore, these approaches are highly sensitive to the movements in exchange rate data and particularly its distributional characteristics. These methods are also conditional upon the form of specification for the inflation equation within which the threshold value will be located. The last approach is this regards is the use of polynomial terms, specifically the squared and cubic terms of exchange rate variable, into the linear models to measure both directional and size asymmetries, as well as handle the composite asymmetry issue. A recent illustration of this approach is Patra et al. (2018).

%∆NEER ≥ 1 Standard Deviation from Mean: Large change[xii] ….(3)

%∆NEER ≤ 1 Standard Deviation from Mean: Small change ….(4)

Given this background, specifications 3 and 5 show the definition of 'small' and 'large' exchange rate change as adopted in the present chapter. This definition compactly captures the quantum of exchange rate change. A precondition of meaningfully using this approach is to ensure that the underlying variable is normal (Pollard and Coughlin, 2004; Brun-Aguerre et al., 2014). As shown in table 5.1 in chapter five, the Jacque-Berra test revealed that NEER has behaved normally across the study period. The dummy variable for appreciation is defined as below.

$$\mathbf{D_A = 1, \text{ if } \%\Delta NEER > 0} \quad \textbf{....(5)}$$

$$\mathbf{D_A = 1, \text{ if } \%\Delta NEER > 3\%} \quad \textbf{...(5.1)}$$

$$\mathbf{D_A = 0, \text{ otherwise}} \quad \textbf{....(6)}$$

Where D_A is the dummy variable for appreciation in exchange rate. Similarly,

$$\mathbf{D_D = 1, \text{ if } \%\Delta NEER < 0} \quad \textbf{....(7)}$$

$$\mathbf{D_D = 1, \text{ if } \%\Delta NEER < 3\%} \quad \textbf{...(7.1)}$$

$$\mathbf{D_D = 0, \text{ otherwise}} \quad \textbf{....(8)}$$

Where, D_D is the dummy variable for depreciation in exchange rate. While the above specifications define the dummy variables for appreciation and depreciation in exchange rate, the following specifications reflect the dummy variables for small and large changes in the exchange rate. Similarly, defining D_S and D_L as the dummy variables for small and large changes.

$$\mathbf{D_S = 1, \text{ if } \%\Delta NEER \leq 1 \text{ Standard Deviation from Mean}} \quad \textbf{....(9)}$$

$$\mathbf{D_S = 0, \text{ otherwise.}} \quad \textbf{....(10)}$$

$$\mathbf{D_L = 1, \text{ if } \%\Delta NEER \geq 1 \text{ Standard Deviation from Mean}} \quad \textbf{....(11)}$$

$$\mathbf{D_L = 0, \text{ otherwise.}} \quad \textbf{....(12)}$$

These definitions of the dummy variables account for the intercept of directional and size asymmetries but not the extent to which these asymmetries shape the ERPT behaviour. Hence, following Goldfajn and Werlang (2000), and Pollard and Coughlin (2004), Kennedy

(2008)[xiii], following interaction variables are defined to capture the asymmetry issues as shown in Table 6.1.

Table: Measurement of Asymmetry variables in the present study

Sr. No.	Variable	Definition	Asymmetric dimension of exchange rate change
1	D_{D*NEER}	$D_D * \Delta InNEER$	Pass-through under Depreciation
2	D_{A*NEER}	$D_A * \Delta InNEER$	Pass-through under Appreciation
3	D_{L*NEER}	$D_L * \Delta InNEER$	Pass-through under Large change
4	D_{S*NEER}	$D_S * \Delta InNEER$	Pass-through under Small change
5	D_{LD}	$D_L * D_D * \Delta InNEER$	Pass-through under Large Depreciation
6	D_{SD}	$D_S * D_D * \Delta InNEER$	Pass-through under Small Depreciation
7	D_{LA}	$D_L * D_A * \Delta InNEER$	Pass-through under Large Appreciation
8	D_{SA}	$D_S * D_A * \Delta InNEER$	Pass-through under Small Appreciation

Source: Author's specification based on Goldfajn and Werland (2000), Pollard and Coughlin (2004), and Kennedy (2008).

2. Key Findings

2.1. Exchange Rate Pass Through to Import Prices

Chapter four has examined various dimensions of the pass-through mechanism linking exchange rate variations and aggregate import price. Section 4.2 laid bare the key issues to be investigated. Section 4.3 examined the nature of the aggregate import basket of India, suggesting some stylized facts. First, the advanced economies broadly captured by the OECD bloc and also the OPEC bloc, have dominated as the key foreign suppliers of India's imports. Their share has persisted between 50% and 55% in the aggregate imports of India. Second, the share of the developing economies in India's import basket has consistently increased since 1991-92 and has reached about 45% in 2021-22. Third, oil imports as a proportion of the aggregate imports have hovered at around 30% since 1991-92 and this signifies the stable demand for oil in India. Clearly, ignoring crude oil in the pass-through estimation would bias the results. Fourth and last, it was found that India's direction of trade with advanced economies has been tilted towards imports relative to what India exports them and interestingly, similar behavior was encountered with the developing economies. This implies that India has been a heavily imports-dependent country and perhaps considerable scope remains open to exploit the export potential of the country.

Thereafter, Section 4.4 laid the foundations of the theoretical model adopted in this chapter after examining the competing approaches available on this subject. The choice of the

theoretical framework was contextualized and the baseline model was proposed which later on provided the foundation for the empirical analyses. Section 4.5 provided the background on the data environment of the study while explaining the nature of the key macroeconomic variables employed in this chapter. Section 4.6 provided a coherent picture of the time-series behavior of the variables and their distributional characteristics before examining the basic time-series properties of these variables. The temporal behavior of the selected variables, the issue of structural breaks in them, and stationarity-related matters was explored in this section. Section 4.7 analyzed the methodological issues in ERPT analysis in both international and Indian contexts and laid the rationale for the key methodological choices made in this chapter. This section also summarized the key debates on methodological considerations in the Indian context on the pass-through issue while rationalizing the methods chosen for empirical analysis in this chapter.

Subsequently, Section 4.8 provided, examined, and contextualized the empirical estimates arrived in this chapter. Within this section, section 4.8.1 estimated the extent of price impact from the exchange rate in terms of aggregate import price in India during the period 1991-92 to 2021-22. The baseline model was estimated and the initial estimate of the pass-through coefficient was worked out to be slightly more than complete. Following it, section 4.8.2 analyzed the issue of macroeconomic determinants of aggregate import price inflation in India within a partial adjustment framework. NEER, Oil price inflation, world inflation, exchange rate volatility, and trade openness were found to be contributing to higher import prices in India. On the other hand, the growth rate of real GDP, the financial crisis of 2008-09, volatility of domestic inflation, and the partial adjustment mechanism was found to be reducing import prices. Both the short-run and the long-run pass-through coefficients were estimated in this section and in both cases, pass-through remained high, though, in the long run, there was slight incompleteness in the same. The impact of the interactions between exchange rate variations and key macroeconomic factors such as inflation level, volatility in inflation, exchange rate volatility, and trade openness, on the import price inflation, was studied in section 4.8.3. The framework in this section allowed examining how these macro factors shaped the price impact of the exchange rate in terms of their combined influence on import price inflation at the aggregate level. Each of these factors was found to be increasing the price impact of the exchange rate on import prices.

Section 4.8.4 took up the issue of stability of the pass-through relationship across time by adopting a rolling regression approach. The estimates of the pass-through coefficient

across selected rolling windows were reported in this section. The estimated time path of the coefficient indicated that the pass-through was complete and remained fairly stable during the sample period. However, a caveat was raised that the issue of the time-varying coefficient could not be sufficiently handled by a simplistic approach such as the rolling regression method. Thus, section 4.8.5 elaborated on the issue of stability of the pass-through coefficient within a time-varying coefficient model that allowed the modeling of a linear model within a state-space framework. This approach was examined in detail and its relative strengths and pitfalls were noted. The estimated time-varying pass-through coefficient displayed instability and structural change after 2009-10 possibly indicating the deep impact of the financial crisis on the exchange rate – import price nexus in India. The rationale was developed for these findings and an important question was raised: Why has the pass-through relationship been unstable across this study period? After examining the time-series properties of the estimated time-varying ERPT coefficient, section 4.8.6 proposed a theoretical model of the macroeconomic process through which the instability of the import price pass-through could be explained. Results showed that an inflationary environment contributed to increasing the extent of instability of pass-through, thereby confirming the Taylor hypothesis that pass-through is endogenous to the domestic inflation environment prevailing in the country. This was undertaken from the perspective of the import price pass-through. Similarly, an increased growth rate of real output and the financial crisis of 2008-09 were found to have increased the instability in the import price pass-through coefficient. However, exchange rate volatility, trade openness, and the introduction of the Flexible Inflation Targeting (FIT) regime in India were found to be stabilizing the pass-through coefficient. Again, the result on the impact of the FIT regime on pass-through vindicated the Taylor hypothesis.

This concludes chapter four and the next section provides a preliminary overview of the issues to be studied in the next chapter where the scope of pass-through analysis is expanded to cover domestic inflation.

2.2. Exchange rate pass-through to domestic prices and dynamic impact of exchange rate movements on inflation

Chapter 5 examined the issue of ERPT to domestic inflation by investigating the nature of short-run and long-run pass-through in India at the aggregate level using quarterly and annual data from 1991-92 to 2021-22. Section 5.1 introduced the issue and provided the analytical background on this matter. It delineated the shift in attention from the quantity to price impacts of exchange rate in modern macroeconomic literature and highlighted the

fundamental concerns of the literature on the price impacts emanating from exchange rate behaviour. Section 5.2 underlined the primary concerns of this work by specifying the key issues and hypotheses to be investigated. The four major issues tasks undertaken in this chapter were laid bare in this section.

Thereafter, Section 5.3 and 5.4 developed the theoretical model adopted in this chapter. By grounding the analysis in a well-defined theoretical framework, the inferences from this chapter can be better contextualized with extant literature and theoretically reliable inferences can be drawn and compared with a-priori expectations. A backward-looking open economy version of the Phillips curve was developed for the Indian economy to study the ERPT issue. The coefficient of pass-through has been found as considerably sensitive to the control variables employed in the inflation equation, particularly the monetary policy variables. Hence, two baseline models were developed in this section. The rationale, context and consistency of the theoretical framework with the extant wisdom was examined in this section. Section 5.5 explained the variables employed, important issues related to their construction, their sources and other allied matters. Section 5.6 presented the descriptive statistical estimates of the macroeconomic variables employed in this study, while also assessing their key time series properties before preparing them for the empirical analysis.

Section 5.7 presented the empirical perspectives. Sub-section 5.7.1 examined the issue of short-run and long-run extents of pass-through in India within a dynamic partial adjustment framework. The primary findings included a higher long-run pass-through as compared to short-run pass-through, fulfilment of the 'incompleteness hypothesis' in the Indian context, inflation inertia and persistence and monetary policy being the primary drivers of inflation after which ERPT played a pivotal role in shaping the inflationary movements in India. Sub-section 5.7.2 investigated the issue of ERPT to domestic inflation using annual data and found the results to be largely consistent with the findings for quarterly data. Sub-section 5.7.3 looked into the issue of stability of the pass-through coefficient as estimated through the two baseline models and found that pass-through had been largely stable across the study period. This finding was robust to alternative econometric methods of studying the intertemporal stability of pass-through coefficient. The rolling regression approach, a Time-Varying-Coefficient (TVC) approach and a Kernel density based TVC approach were employed. All the approaches yielded the same finding – pass-through to domestic inflation has been stable over time.

Sub-section 5.7.4 studied the pass-through phenomenon by relaxing the ceteris paribus assumption and allowing richer dynamics into the macroeconomic transmission process from exchange rate shocks to domestic prices using a Structural Vector Auto Regression approach. The structural decomposition approach allowed tracing the impulse responses and variance decompositions which formed the primary issues of concern in this approach. Pass-through to WPI inflation was found to be lower than for CPI inflation with higher transmission of price impulses from WPI to CPI. The dynamic elasticity estimates further testified these findings. Consistent with the findings from the single equation models used earlier in the chapter, inflation was found to be largely driven by its inertia and displayed persistence over time. The importance of ERPT channel was found to be increasing over time.

2.3. Direction and Size asymmetries in exchange rate pass-through to import and domestic inflation

Chapter 6 examined the issue of directional asymmetry – defined as the differences in pass-through between appreciation and depreciation of exchange rate, size asymmetry – defined as the difference in pass-through coefficient for large change versus small change, and composite asymmetry – defined as the differences in pass-through coefficient for combinations of size and directional asymmetries. The analysis was conducted separately for pass-through to both the import prices, as well as to domestic prices. Multiple methodologies were adopted to specify the dummy variables used for estimating asymmetries along with other alternative approaches.

Section 6.2 examined the nature of the asymmetries to be captured in the chapter. The theoretical model adopted for capturing asymmetry was elaborated therein. Thereafter, section 6.3 addressed the dimensions of asymmetries in pass-through to import prices using annual data from 1991-92 to 2021-22. It was found that pass-through from depreciation was complete while the pass-through from appreciations was more-than-complete. Appreciations were found to be inducing larger pass-through than depreciation in the case of import prices. Furthermore, smaller changes were found to be associated with larger pass-through as compared to larger changes and the finding was robust to alternative size criteria. The findings on the size asymmetry in import price pass-through was found to be consistent across all the three approaches. With regards to the issue of composite asymmetry, the

findings were not strongly evident, though indications were obtained that small depreciations had a larger pass-through than other forms of asymmetries.

Similarly, section 6.4 examined these dimensions with reference to the ERPT to local inflation within the Indian economy during 1991-92 to 2021-22 while using quarterly data. With reference to directional asymmetry, evidence suggested that Depreciations in exchange rate had a higher pass-through as compared to appreciations. This finding was consistent with the findings in literature such as Brun-Aguerre (2014), Patra et al. (2018), and others. This finding was robust to the alternative empirical methodologies adopted for examining this issue. With regards to size asymmetries, small changes were found to have larger pass-through than large changes in exchange rate, though the 'incompleteness hypothesis' was maintained in both the cases. This finding was not consistent for the two approaches employed in this context. While the dummy variable approach indicated smaller exchange rate changes as inducing larger pass-through, the polynomials approach suggested that larger changes had a higher extent of price impact from exchange rate alterations. Lastly, composite asymmetry in pass-through to domestic prices was scrutinized and evidence depicted that large depreciations had the highest impact on domestic prices while large appreciations had the lowest impact.

Chapter 6 has thus provided important insights on not only whether asymmetry exists, but also on the nature of asymmetries in the pass-through mechanism in India. Three-dimensional asymmetries were empirically tested for – namely directional, size and composite. The evidence with regards to import prices indicated that India is a price-taker as far as imports are concerned, though the exporting firms were displaying PTM behaviour and perhaps were focused on increasing their market shares while not sacrificing their markups in the wake of depreciation of the Indian currency. Such a behaviour fits well with the observed results in chapter four and there is considerable evidence that nonlinear behaviour is prevalent in the import price pass-through mechanism. Similarly, the evidence on the issue of asymmetries in pass-through to domestic prices suggests that there is considerable absorption of the inflationary impulses emanating from currency fluctuations, but the pass-through is larger for depreciations as compared to appreciation. Despite being incomplete, the inflationary impact of exchange rates remains a matter of concern. It was also seen that small changes were having a larger transmission to domestic prices as compared to large changes, which is consistent with the findings for the import price pass-through also. However, when the size and directional asymmetries are synthesized, the findings suggested that large

depreciations were inducing the highest pass-through as compared to other forms of nonlinearities. This is another testimony of the fact that ERPT remains an important channel for transmission of inflationary momentum to the domestic prices in India. The fears of the floating regime continue to prowl the policymaker.

3. Conclusions

This study has investigated the subject of Exchange Rate Pass-Through, i.e. ERPT, to import prices as well as domestic prices in India for the period 1991-92 to 2021-22 at the aggregate level using both quarterly and annual data. Quarterly information was utilized for the analysis of pass-through to domestic prices, while annual information were employed for the analysis of import price pass-through. This study has contributed to the extant wisdom in several ways.

First, the analysis of both the import price and domestic price pass-through from exchange rate variations in a single work provides a well-articulated framework of studying the price impacts of exchange rate alterations. Generally, literature in the Indian context has treated both the dimensions of pass-through mechanism separately with some studies focusing exclusively on the import price issue while others attending the pass-through phenomenon from the standpoint of domestic prices. By undertaking an assessment of both the stage one and the full pass-through process, this work has provided a more coherent perspective that can be utilized to compare how exchange rate interacts with the different sets of prices in India. Second, as explained in chapter two, the literature on this subject-matter is rather limited in the Indian setting. There is a large scope for addressing the various aspects of the pass-through process and provide fresher perspectives on how exchange rate variations interact with trade and domestic prices. The present study is an attempt in that direction. Third, the analysis of ERPT to import prices has been much more limited in the Indian arena relative to the focus given to domestic prices. This study has provided a larger and more exhaustive perspective on the nature of pass-through mechanism with regards to import prices using a longer time series data, capturing the entire period after the reforms, and adopting novel theoretical and methodological approaches. More importantly, it provided perspectives not only on the basis of baseline models, but incorporated multiple perspectives to gauge the sensitivity of pass-through to different specifications.

Fourth, the nature of import price behaviour is critical to properly capturing the extent of ERPT. Very few studies have elaborately examined the determinants of the import price

inflation in India while locating ERPT as one channel within this larger issue. The present study has undertaken this task in chapter four. Fifth, the extent of ERPT to import prices under different theoretical specifications has not been actively studied in the Indian context. This dimension has been covered in this work. Sixth, the determinants of import price pass-through coefficient, both from the indirect approach in terms of interactive dummy variables and the direct approach wherein the pass-through coefficient is itself utilized as a dependent variable, is an area where large scope of analysis has remained open. Some progress in that direction has been advanced in this study. Seventh, the time-varying nature of the import price pass-through coefficient has been investigated in this study while also focusing on its determinants. This is another fresh dimension contributed by the present work. Eighth, the scrutiny of the temporal behaviour of the pass-through coefficient using multiple econometric methodologies is another unique aspect of this study and provides a fresh perspective on the subject.

The second fundamental concern of this work was the nature of pass-through to domestic prices from exchange rate variations. Several focal issues were deliberated in chapter five on this subject. First, this study has estimated the short and long run pass-through to domestic prices for a considerably longer study period, ranging from the economic reforms till date. This period captures the liberal era of the Indian economy and accounts for several structural changes – both in policy and the institutions. The estimated results represent the nature of pass-through during this era and the scope of the chapter is considerably larger than many of the studies undertaken so far. Second, the estimation of pass-through using both the quarterly and annual data provided an opportunity to reflect on the sensitivity of results to the frequency of data. It was found that the extent of pass-through remains largely invariant to this dimension.

Third, the stability of the impact of exchange rate alterations on domestic prices was investigated using different econometric approaches, which suggested a time-invariant pass-through to domestic prices, unlike in the case of import prices where pass-through coefficient increased over time. Fourth, the dynamic interactions and the complex feedback relationships between exchange rate and domestic prices were captured through the SVAR model. The entire period after the economic reforms was captured in this framework and important insights were obtained on this issue. Fifth, chapter five synthesized multiple dimensions of the pass-through mechanism into a single analytical framework, allowing meaningful comparatives to be drawn from the empirical results. The holistic perspective provided in

chapter five contributes a more coherent perspective on the subject matter in the extant literature.

The fourth fundamental subject-matter examined in this study was the non-symmetrical behaviour of the price impacts emanating from exchange rate variations. Chapter six addressed this issue by adopting multiple definitions of directional, size and composite asymmetries while also adopting multiple analytical approaches. In contrast to the extant literature, this study investigated asymmetry issue for both the import price as well as domestic price pass-through in India within a single volume. Furthermore, consistency with the previous models was maintained to allow extend the linear econometric models to capture nonlinear dimensions while permitting comparison across diverse methods and inferences. With the entire period after economic reforms under consideration, the inferences yielded by the estimates of chapter six provided a coherent and broader perspective on the issue of nonlinear pass-through in India. The issue of asymmetries was extended to alternative baseline models to gauge the sensitivity of asymmetries to alternative methods, definitions and econometric approaches. The analytical apparatus developed in chapter six provides a unique perspective on size, directional and composite asymmetries, while drawing comparatives between the pass-through to import prices and domestic prices. While being parsimonious in its approach, the findings provided credible evidence on the existence and nature of nonlinearities in the transmission of price impact emerging from exchange rate movements.

4. Implications and Recommendations

Macroeconomic analysis grounds itself deep into policy concerns that are shaped by the trade-offs between the pursuit of output, inflation and employment. The genesis of the Keynesian revolution laid in the economic crisis which necessitated an intellectual revolution that would allow policy as a means to achieve what market were unable to. Concomitantly, the responses of the classical school resonated the inherent superiority of the market mechanism in advancing prosperity and development as against an interventionist design that would rather worsen the coordination 'errors' committed by markets. An extremist view on this issue emerged in the Austrian school led by Mises (1966) who argued that the apparent coordination failures alleged by the Keynesian school were actually the manifestations of interventionist policies that prevented markets to reset to their self-equilibrating path following a crisis. These debates have led to a voluminous literature on how effective policies

are in promoting the prosperity and growth. For an emerging economy like India, the challenges portrayed by its current macroeconomic state are large and perhaps a sole reliance of market forces would not permit the rapid resolution of these constraints. A pro-active market-oriented framework defines the current macroeconomic policy environment in India. Such a milieu is capable of incorporating the external sector effectively as a means to achieve the core macro objectives of growth, stability and employment. It is with this spirit that the results obtained in the present study should be contextualized.

India has shifted to a floating currency system since the introduction of the Liberalized Exchange Rate Management System (LERMS) in the 1990s. The RBI has increasingly preoccupied itself with the management of the variability in the value of Indian currency while allowing its trend to emerge through the market logic. The shift to a floating regime has opened an additional channel that could transmit inflationary consequences. The inflationary implications of exchange rate are not only due to the change in its level but also due to its volatility. As investigated in chapters four and five, exchange rate volatility can affect both the trade and domestic prices as well as the extent of pass-through itself. Exchange rate management is one of the cornerstones of the modern times that the central bank in India has to undertake. The central bank is concerned with not only the rate of exchange but also the volatility in the same. Chapter four assessed how currency volatility impacts aggregate import price inflation. It was found that there is an inflationary impact on imports emanating from volatility in currency rate. The magnitude of this impact was small but statistically significant. For a 10% increase in the volatility of exchange rate, about 1.1% to 1.2% increase in import prices was observed during the sample period. Chapter four further found that volatility in currency is not only responsible for directly imposing inflationary pressure but also increases the extent of pass-through effects of exchange rate. The interaction term of exchange rate and its volatility in the import price function suggested that a volatile rupee is capable of putting upwards pressure on not only import prices but also the extent of pass-through.

Hence, the transmission of currency impulses to inflation is further accentuated when the exchange rate is more volatile. Consequently, the first and second moments of the distribution of exchange rate variations over time are critical in assessing the price implications of currency movements in India. The central bank is very much justified in stabilizing the variability of the currency value but this must be undertaken while also accounting for the trend in the exchange rate and more importantly, the interlinkages between

the value of the currency and its volatility. Clearly, the inflationary potential of exchange rate still remains a serious issue for exchange rate management. Inflation is not restricted to trade prices and is a larger issue when considered from the perspective of domestic prices. Chapter five investigated the linkages between exchange rate alterations and aggregate local prices. Across alternative empirical specifications, exchange rate shifts continued to impose upwards pressure on domestic prices. The inflationary tendencies of currency fluctuations have continued to rendezvous the policymaker in India since the economy began restructuring itself to a more open and liberalized macro environment. The pass-through impact remained incomplete throughout the sample period. Hence, while import prices were strongly shaped by exchange rate shocks, the inflationary impulses from import prices have not been fully dispersed into the domestic markets, perhaps demonstrating the absorption of adverse currency movements across the aggregate distribution chain.

Inflation management is another area where the findings of this study could provide important insights and indications. Stability in the general price level is necessary to ensure a stable and less uncertain macroeconomic environment for individuals, firms and institutions to interact effectively in the markets. The central bank undertakes this task through the monetary policy that includes a host of quantitative and qualitative tools including the variations in the stock of money and the credit policy. The external sector has been impacting the domestic markets through both the trade prices as well as through the interaction of currency fluctuations with other macroeconomic variables such as the level of inflation itself, inflation volatility, exchange rate volatility and trade openness. The fact that the pass-through to aggregate local prices is incomplete indicates the success of the central bank in containing the inflationary impulses of exchange rate. However, this also implies that the current stance must be maintained to ensure that the pass-through remains low. Furthermore, the stability of the ERPT coefficient to domestic prices was found to be high, with a largely time-invariant inflationary impact of currency variations. However, import prices remain a critical area of concern which could trigger a larger pass-through if not controlled for. The pass-through coefficient for aggregate import prices was found to have risen over time as shown in chapter four. There is good amount of inflationary pressure manifested in the import prices in India. These manifestations are not transmitted fully into the local prices but the real implications of these price pressures could translate into other channels through which currency variations could cause higher inflation in local prices. There may be quantity channels at play that could very well transmit the inflationary impulses built at the level of import prices to the domestic

prices (Laflèche, 1996). Further research can pursue this line of thought and estimate the pass-through impact of currency alterations via both the price and quantity channels. Perhaps, this could allow better incorporating of the external channel of inflation in monetary management in India.

A special theme associated with inflation management is the role of the change in monetary regimes on inflation and the pass-through from currency to local prices. Since October 2016, the RBI has adopted the Flexible Inflation Targeting (FIT) regime, whereby the central bank has committed itself to a pre-specified quantitative target for the tolerable level of inflation. This event has resulted in the direct testing of the so-called Taylor's hypothesis ascribed to Taylor (2000). The present study examined this matter in chapters four and five. The findings in chapter four suggested that the transmission of inflationary momentum from changes in the value of currency to imports has reduced sizeably since the introduction of the FIT regime. While there is a clear evidence of inflationary pressure being manifested at the level of import prices, the ability of a credible monetary policy in reducing the inflationary consequences of the external sector testifies the Taylor's hypothesis in case of India. Chapter five looked into the role of this regime change in affecting domestic prices. The evidence again testified the hypothesis that ERPT is endogenous to monetary policy. The central bank can continue to control the percolation of upward price pressures from trade prices to domestic prices by strictly adhering to the well-defined quantitative inflation target. Chapter five also portrayed the persistence[xiv] in domestic inflation in India. This is a matter of concern and the persistence in inflation could result into further acceleration if the credible commitment to the inflation targets are not honoured. It may also be possible for the pass-through effects from import prices to domestic prices rise if large deviations from the targeted inflation rate are tolerated for longer durations. It is also evident from chapter five that inflation in India has reduced due to the introduction and continuation of the FIT regime. While the disinflationary gains were small in this case, it nevertheless showed that despite the higher momentum built at the level of trade prices, credibly committed monetary policy can contain the same and prevent their manifestation on the local price structure.

Currently, India has been promoting exports while pushing for rationalization of imports. The policy objective of recalibrating the trade composition is in part conditional upon the extent of pass-through. Higher pass-through effects could allow a larger scope for changing the trade composition in favour of exports given a higher price elasticity of imports and exports. Alternatively, the trade composition could worsen under these circumstances if

the exchange rate appreciated instead of depreciating. The Indian currency has been depreciating since the reforms began in the early 1990s as shown in chapter three. Hence, exchange rate depreciation has been more frequent than appreciation and there exists considerable scope to discourage imports while pushing the exports in the international arena[xv]. Contrastingly, if the pass-through is low, then the ability of the government in pushing a shift in trade composition in favour of exports following a depreciation is constrained. The policymakers might need to incentivize exports and discourage imports through non-market interventions such as tariffs which tend to distort the trade flows and could produce unexpected consequences such as trade and consumption biases among others. Such policies could also alter the domestic production structure by unnaturally shifting the composition of trade in suboptimal directions. Given that the pass-through to import prices is complete, there exists comfortable room for inducing compositional changes in the aggregate trade by utilizing the inflationary impact of exchange rate on imports while containing its further transmission into the local price structure.

Inflation has shown a backward-looking behaviour in the Indian context along with being largely driven by money supply and currency variations. The open economy framework highlights the role of the external sector in shaping the local price structure in India both at the wholesale and consumer price levels. Chapter five addressed this dimension and found that inflation is considerably impacted by external forces while being dominantly shaped by internal sources. The finding that inflation is backwards looking also indicates the need to thoroughly account for the role of adaptive expectations in monetary policy formulation[xvi]. As explained earlier in this section, if inflation is indeed persistent, mismanagement in one period could continue to cause ripples of its consequences over a longer time period in the future, thereby rendering monetary policy ineffective in stabilizing the prices. On the other hand if persistence is utilized as an opportunity to transmit stability from one period to the next, then ensuing that pass-through remains low and incomplete is a necessity. If higher pass-through seeps into the domestic price structure, it could result into inflationary impulses that last longer than expected, warranting much more aggressive contractionary stance that could hinder the growth objective. Coherent coordination between the monetary and fiscal goals need to be established while accounting for the extent of pass-through, the reasons for its incompleteness and its stability over time. Under such a policy design, the external sector would not cause as much inflationary distortions as it would were the nature of pass-through not accounted for.

In chapter five, the pass-through process was synthesized with the real sector to allow the price transmissions from exchange rate to culminate and conclude into the quantity adjustments. Monetary policy framework must not only scrutinize the price relationships ingrained in the ERPT conceptualization, but also the quantity adjustments that underlie these price interconnections. While chapter five addressed the interactions between the monetary and real sectors in the pass-through process, a larger macro model of ERPT that accommodates more complex quantity relationships and their feedbacks and interactions with the price relationships could shed much better light on how exchange rate movements interfere with domestic macro objectives of growth, price stability and employment. The attempt made in section 5.7.4 provided a compact perspective on this matter. The extent of pass-through was considerably lower for wholesale prices but showed relatively larger implications for consumer prices when a dynamic framework with the real sector was adopted. The differential impact of currency fluctuations on different prices has been debated off-lately in the Indian context. But the findings have not been in agreement. Furthermore, the studies addressing the impact of exchange rate changes on different prices tended to ignore the real sector. Better policy inferences can be drawn if both the monetary and real sectors are allowed to interact in shaping the pass-through process.

Lastly, the interactions between the wholesale and consumer markets is a critical dimension that emerged from the dynamic structural analysis conducted in chapter five through the SVAR framework. It was found that the price momentum induced by currency alterations were in large part pass-over from wholesale markets to the retail markets. The dynamic elasticity of consumer prices with respect to the wholesale prices and the impulse response function of CPI indicated these observations. The dynamics at play in the interaction between wholesale and consumer markets is a critical area of concern for monetary policy in its pursuit for stabilization of prices. If consumer prices are targeted but the source of inflationary momentum resides in wholesale price movements, then perhaps it is the wholesale market whose reactions to external and domestic shocks that should be examined in order to contain the price dispersion at the retail level. There is a larger scope for price shocks to disperse in the retail markets and given that the consumers do not display much of monopsony behaviour, the pass-over from wholesale to retail markets is rapid and unhindered. On the other hand, the wholesale markets present a different picture wherein the agents are larger in scale, may command market power and could influence the price discovery process itself. Monetary policy design should accommodate these features of the

wholesale markets while also accounting for its dynamic interaction with the consumer markets so that any feedback cycles between these markets are prevented, which otherwise could induce a self-propelling inflation process that distorts the pursuit of macro price stability.

Bibliography

1. Abul Naga, R., Stapenhurst, C., & Yalonetzky, G. (2020). Asymptotic Versus Bootstrap Inference for Inequality Indices of the Cumulative Distribution Function. *Econometrics*, *8*(1), Article 1. https://doi.org/10.3390/econometrics8010008
2. Acharyya, R. (2013). *International Economics: An Introduction to theory and policy*. Oxford University Press.
3. Akintunde, M. O., Oyekunle, J. O., & Olalude, G. A. (2015). Detection of Non-Linearity in the Time Series Using BDS Test. *Science Journal of Applied Mathematics and Statistics*, *3*(4), Article 4. https://doi.org/10.11648/j.sjams.20150304.13
4. Alex, D. (2019). Time Varying Trend Inflation and Inflation Volatility: The Case of China and India. *Social Science Research Network (SSRN)*. https://doi.org/10.2139/ssrn.3334250
5. Alvarez, R., Shoja, A., Uddin, S., & Yilmazkuday, H. (2019). Daily exchange rate pass-through into micro prices. *Applied Economics Letters*, *26*(6), 440–445. https://doi.org/10.1080/13504851.2018.1486972
6. Amos, M. B. (2009). *Macroeconomic Policy Analysis: Open Economies with Quantity Constraints*. Cambridge University Press. https://www.cambridge.org/in/academic/subjects/economics/macroeconomics-and-monetary-economics/macroeconomic-policy-analysis-open-economies-quantity-constraints?format=PB#contentsTabAnchor
7. An, L., & Wang, J. (2011). *Exchange Rate Pass-through: Evidence Based on Vector Autoregression with Sign Restrictions* [Working Paper series]. Federal Reserve Bank of Dallas Globalization and Monetary Policy Institute. https://www.dallasfed.org/research/international/wpapers
8. Anand, R., & Prasad, E. S. (2010). *Optimal Price Indices for Targeting Inflation Under Incomplete Markets* (Working Paper No. 16290). National Bureau of Economic Research. https://doi.org/10.3386/w16290
9. Armington, P. S. (1969). A Theory of Demand for Products Distinguished by Place of Production. *Staff Papers (International Monetary Fund)*, *16*(1), 159–178. https://doi.org/10.2307/3866403
10. Arndt, S. W., & Huemer, A. (2007). Trade, Production Networks and the Exchange Rate. *The Journal of Economic Asymmetries*, *4*(1), 11–39. https://doi.org/10.1016/j.jeca.2007.01.002

11. Aron, J., Macdonald, R., & Muellbauer, J. (2014). Exchange Rate Pass-Through in Developing and Emerging Markets: A Survey of Conceptual, Methodological and Policy Issues, and Selected Empirical Findings. *The Journal of Development Studies*, *50*(1), 101–143. https://doi.org/10.1080/00220388.2013.847180
12. Arora, S. S., Bahmani-Oskooee, M., & Goswami, G. G. (2003). Bilateral J-Curve Between India and Her Trading Partners. *Applied Economics, Routledge, Taylor and Francis Group.*, *35*, 1037–1041. https://doi.org/10.1080/0003684032000102172
13. Arsova, A. (2019). *Exchange rate pass-through to import prices in Europe: A panel cointegration approach* [University of Lüneburg Working Paper Series in Economics No. 384]. www.leuphana.de/institute/ivwl/publikationen/working-papers.html
14. Asfuroğlu, D. (2021). The Determinants of Inflation in Emerging Markets and Developing Countries: A Literature Review. *Anadolu Üniversitesi Sosyal Bilimler Dergisi*, *21*(2), Article 2. https://doi.org/10.18037/ausbd.959251
15. Aslam, A., Boz, E., Cerutti, E. M., Marcos, P. R., & Topalova, P. (2017). *The Slowdown in Global Trade: A Symptom of A Weak Recovery* [International Monetary Fund IMF Working Paper No. 242]. International Monetary Fund. https://www.imf.org/en/Publications/WP/Issues/2017/11/15/The-Slowdown-in-Global-Trade-A-Symptom-of-A-Weak-Recovery-45352
16. Aydoğuş, O., Değer, Ç., Tunalı Çalışkan, E., & Gürel Günal, G. (2018). An input–output model of exchange-rate pass-through. *Economic Systems Research*, *30*(3), 323–336. https://doi.org/10.1080/09535314.2017.1374243
17. Aziz, M. N., Horsewood, N., & Sen, S. (2014). The First and Second Stage Pass-through of Exchange Rates: A Developing Country Perspective. *Review of Development Economics, John Wiley and Sons Ltd.*, *18*(3), 595–609. https://doi.org/10.1111/rode.12105
18. Aziz, N., & Ahmad, A. H. (2018). Exchange rate hysteresis in the UK imports from the South Asian Countries. *International Review of Economics & Finance*, *58*, 159–178. https://doi.org/10.1016/j.iref.2018.03.007
19. Aziz, N., Rahman, M., Majumder, Md. A., & Sen, S. (2013). Exchange Rate Pass-Through to External and Internal Prices: A Developing Country Perspective. *Journal of Applied Business and Economics*, *15*, 128–143.
20. Bai, J., & Perron, P. (1998). Estimating and Testing Linear Models with Multiple Structural Changes. *Econometrica*, *66*(1), 47–78. https://doi.org/10.2307/2998540
21. Bai, J., & Perron, P. (2003). Computation and analysis of multiple structural change models. *Journal of Applied Econometrics*, *18*(1), 1–22. https://doi.org/10.1002/jae.659

22. Balakrishnan, P., & Mavannoor, P. (2007). Understanding Economic Growth in India: A Prerequisite. *Economic and Political Weekly*, *42*, 2915–2922. https://doi.org/10.2307/4419790
23. Balcilar, M., & Usman, O. (2021). Exchange rate and oil price pass-through in the BRICS countries: Evidence from the spillover index and rolling-sample analysis. *Energy*, *229*, 120666. https://doi.org/10.1016/j.energy.2021.120666
24. Balcilar, M., Roubaud, D., Usman, O., & Wohar, M. E. (2019). *Testing the Asymmetric Effects of Exchange Rate and Oil Price Pass-Through in BRICS Countries: Does the state of the economy matter?* (Discussion Paper Series, Department of Economics, Eastern Meditarian University. Discussion Paper 15-49 No. 15–49). Eastern Mediterranean University, Department of Economics. https://ideas.repec.org//p/emu/wpaper/15-49.pdf.html
25. Baldwin, R. (1988). *Hysteresis In Import Prices: The Beachhead Effect* (Working Paper No. 2545). National Bureau of Economic Research. https://doi.org/10.3386/w2545
26. Ball, L., Chari, A., & Mishra, P. (2016). *Understanding Inflation in India* [NBER Working Paper Series]. National Bureau of Economic Research. https://doi.org/10.3386/w22948
27. Baqueiro, A., de Leon, A. D., & Torres, A. (2003). *Fear of floating or fear of inflation? The role of the exchange rate pass-through* (pp. 338–354) [BIS Papers chapters]. Bank for International Settlements. https://econpapers.repec.org/bookchap/bisbisbpc/19-14.htm
28. Baqueiro, A., Leon, A. D. de, & Torres, A. (2003). Fear of floating or fear of inflation? The role of the exchange rate pass-through. *BIS Papers Chapters*, *19*, 338–354.
29. Barhoumi, K. (2006). Differences in long run exchange rate pass-through into import prices in developing countries: An empirical investigation. *Economic Modelling*, *23*(6), 926–951. https://doi.org/10.1016/j.econmod.2006.04.006
30. Baumeister, C., & Hamilton, J. D. (2021). Advances in Using Vector Autoregressions to Estimate Structural Magnitudes. *The Econometric Theory Lecture at the EC2*, 1–41. https://econweb.ucsd.edu/~jhamilto/BH7.pdf
31. Baxter, M., & King, R. G. (1999). *Measuring Business Cycles:Approximate Band-Pass Filters for EconomicTime Series*. 1–36.
32. Bayoumi, T., & Darius, R. (2011). *Reversing the Financial Accelerator: Credit Conditions and Macro-Financial Linkages* (p. 35) [Working Paper Series]. International Monetary Fund. https://www.imf.org/en/Publications/WP/Issues/2016/12/31/Reversing-the-Financial-Accelerator-Credit-Conditions-and-Macro-Financial-Linkages-24610

33. Behera, H., Wahi, G., & Kapur, M. (2017). *Phillips Curve Relationship in India: Evidence from State-Level Analysis* (RBI Working Paper Series, Working Paper No. 08 id:11973). eSocialSciences. https://ideas.repec.org//p/ess/wpaper/id11973.html
34. Belaire-Franch, J., & Contreras, D. (2002). How to compute the BDS test: A software comparison. *Journal of Applied Econometrics*, *17*(6), 691–699. https://doi.org/10.1002/jae.679
35. Betts, C., & Devereux, M. B. (2000). Exchange rate dynamics in a model of pricing-to-market. *Journal of International Economics*, *50*(1), 215–244. https://doi.org/10.1016/S0022-1996(98)00036-1
36. Bhanumurthy, N. R., Bose, S., & Panda, S. (2014). *Modeling India's External Sector: Review and Some Empirics* (Working Paper Series. No. 14/138). National Institute of Public Finance and Policy. https://ideas.repec.org//p/npf/wpaper/14-138.html
37. Bhanumurthy, N. R., Das, S., & Bose, S. (2012). *Oil Price Shock, Pass-through Policy and its Impact on India* [Working Paper]. National Institute of Public Finance andPolicy. https://www.nipfp.org.in/media/medialibrary/2013/04/wp_2012_99.pdf
38. Bhat, J. A., & Bhat, S. A. (2021). On the dynamics of exchange rate pass-through: Asymmetric evidence from India. *International Journal of Emerging Markets*, *17*(8), 2110–2133. https://doi.org/10.1108/IJOEM-12-2019-1071
39. Bhat, J. A., Nain, Md. Z., & Bhat, S. A. (2022). Exchange rate pass-through to consumer prices in India – nonlinear evidence from a smooth transition model. *International Journal of Finance & Economics, Wiley and Sons Ltd.* https://doi.org/10.1002/ijfe.2714
40. Bhatt, V., & Kundan, K. N. (2016). Measuring Trend Inflation and Inflation Persistence for India. In C. Ghate & K. M. Kletzer (Eds.), *Monetary Policy in India: A Modern Macroeconomic Perspective* (pp. 335–356). Springer India. https://doi.org/10.1007/978-81-322-2840-0_11
41. Bhattacharya, R., Patnaik, I., & Shah, A. (2008). Exchange rate pass-through in India.
42. Bhattacharyya, R., & Rit, B. (2018). On the Relationship between the Nominal Exchange Rate and Export Demand in India. *South Asian Journal of Macroeconomics and Public Finance*, *7*(2), 260–282. https://doi.org/10.1177/2277978718795777
43. Bianchi, & Couliably, L. (2023). *A Theory of Fear of Floating* [Federal Reserve Bank of Minnearpolis Working Paper, Working Paper No. 796]. https://www.minneapolisfed.org/research/working-papers/a-theory-of-fear-of-floating

44. Bisaglia, L., & Gerolimetto, M. (2014). *Testing for (non)linearity in economic time series: A Monte Carlo comparison* [Working Paper Series No. 3]. Core. https://core.ac.uk/download/pdf/31144416.pdf
45. Blanchard, O. (2016). The Phillips Curve: Back to the '60s? *American Economic Review*, *106*(5), 31–34. https://doi.org/10.1257/aer.p20161003
46. Blanchard, O., & Galí, J. (2007). Real Wage Rigidities and the New Keynesian Model. *Journal of Money, Credit and Banking,Wiley, Ohio State University Press*, *39*, 35–65.
47. Borio, C., & Disyatat, P. (2010). Unconventional monetary policies: An appraisal. *The Manchester School*, 53–89. https://doi.org/10.1111/j.1467-9957.2010.02199.x
48. Brock, W.A., W.D. Dechert, and J.A. Scheinkman. (1986). A test for independence based on the correlation dimension, Discussion paper (Department of Economics, University of Wisconsin, Madison).
49. Brun-Aguerre, R., Fuertes, A.-M., & Greenwood-Nimmo, M. (2014). *Heads I Win, Tails You Lose: Asymmetry in Aggregate Exchange Rate Pass-Through* [Working Paper].
50. Brun-Aguerre, R., Fuertes, A.-M., & Matthew, G.-N. (2016). Heads I Win, Tails You Lose: Asymmetry in Exchange Rate Pass-Through Into Import Prices. *MPRA Paper*, Article 71764.
51. Brun-Aguerre, R., Fuertes, A.-M., & Phylaktis, K. (2012). Exchange rate pass-through into import prices revisited: What drives it? *Journal of International Money and Finance*, *31*(4), 818–844. https://doi.org/10.1016/j.jimonfin.2012.01.009
52. Bussière, M. (2007). *Exchange rate pass-through to trade prices: The role of non-linearities and asymmetries* [Working Paper series]. European Central Bank. https://www.ecb.europa.eu/pub/pdf/scpwps/ecbwp822.pdf
53. Bussiere, M. (2013). Exchange Rate Pass-through to Trade Prices: The Role of Nonlinearities and Asymmetries*. *Oxford Bulletin of Economics and Statistics*, *75*(5), 731–758. https://doi.org/10.1111/j.1468-0084.2012.00711.x
54. Bussière, M., & Peltonen, T. (2008). *Exchange Rate Pass-Through in the Global Economy The Role of Emerging Market Economies* [European Central Bank Working Paper Series, Working paper no. 951]. ecb.europa.eu/pub/pdf/scpwps/ecbwp951.pdf
55. Bussière, M., Gaulier, G., & Steingress, W. (2020). Global Trade Flows: Revisiting the Exchange Rate Elasticities. *Open Economies Review,Springer.*, *31*(1), 25–78. https://doi.org/10.1007/s11079-019-09573-3
56. Byrne, J. P., Chavali, A. S., & Kontonikas, A. (2010). Exchange Rate Pass Through To Import Prices: Panel Evidence From Emerging Market Economies. *Working Papers*

2010_19, Business School - Economics, University of Glasgow., Article 2010_19. https://ideas.repec.org//p/gla/glaewp/2010_19.html

57. Ca' Zorzi, M., Hahn, E., & Sanchez, M. (2007). Exchange Rate Pass-Through in Emerging Markets. *European Central Bank Working Paper Series*. https://doi.org/10.2139/ssrn.970654
58. Ca' Zorzi, M., Hahn, E., & Sánchez, M. (2007). *Exchange Rate Pass-Through in Emerging Markets* [European Central Bank Working Paper Series, Working paper no. 739]. https://www.ecb.europa.eu/pub/pdf/scpwps/ecbwp739.pdf
59. Calvo, G. A., & Reinhart, C. M. (2002). Fear of Floating. *The Quarterly Journal of Economics*, *117*(2), 379–408. https://doi.org/10.1162/003355302753650274
60. Campa, J. M., & Goldberg, L. S. (2005). Exchange Rate Pass-through into Import Prices. *The Review of Economics and Statistics,The MIT Press*, *87*(4), 679–690.
61. Campos, J., Ericsson, N. R., & Hendry, D. F. (2005). *General-to-specific Modeling: An Overview and Selected Bibliography* [International Finance Discussion Papers, No. 838]. Board of Governors of the Federal Reserve System. https://www.federalreserve.gov/econres/ifdp/general-to-specific-modeling-an-overview-and-selected-bibliography.htm
62. Carrière-Swallow, Y., Gruss, B., Magud, N. E., & Valencia, F. (2016). *Monetary Policy Credibility and Exchange Rate Pass-Through* [IMF Working Paper, No. 240]. International Monetary Fund. https://www.imf.org/en/Publications/WP/Issues/2016/12/31/Monetary-Policy-Credibility-and-Exchange-Rate-Pass-Through-44458
63. Casini, A., & Perron, P. (2018). *Structural Breaks in Time Series* [Research Article for Oxford Research Encyclopedia of Economics and Finance.]. https://www.bu.edu/econ/files/2019/01/structural-change-oxford.pdf
64. Cavoli, T., & Rajan, R. S. (2013). South Asian Exchange Rates Regimes: Fixed, Flexible or Something In-between? *South Asia Economic Journal*, *14*(1), 1–15. https://doi.org/10.1177/1391561413477929
65. Cerra, V., & Saxena, S. C. (2002). What Caused the 1991 Currency Crisis in India? *IMF Staff Papers*, *49*(3), 395–425.
66. Chandavarkar, A. (2005). Towards an Independent Federal Reserve Bank of India: A Political Economy Agenda for Reconstitution. *Economic and Political Weekly*, *40*(35), 3837–3845.

67. Chen, H., & Hu, W.-Z. (n.d.). Research on exchange rate pass-through effect based on artificial intelligence approach. *Research on Exchange Rate Pass-through Effect Based on Artificial Intelligence Approach*, *31*(9). Retrieved May 3, 2023, from https://onlinelibrary.wiley.com/doi/abs/10.1002/cpe.4986
68. Chen, N., Chung, W., & Novy, D. (2019). *Vehicle Currency Pricing and Exchange Rate Pass-Through* (CESifo Working Paper Series 7695, CESifo No. 7695). CESifo. https://ideas.repec.org//p/ces/ceswps/_7695.html
69. Chen, N., Chung, W., & Novy, D. (2022). Vehicle Currency Pricing and Exchange Rate Pass-Through. *Journal of the European Economic Association,Oxford University Press.*, *20*(1), 312–351. https://doi.org/10.1093/jeea/jvab025
70. Choudhri, E. U., & Hakura, D. S. (2006). Exchange rate pass-through to domestic prices: Does the inflationary environment matter? *Journal of International Money and Finance*, *25*(4), 614–639. https://doi.org/10.1016/j.jimonfin.2005.11.009
71. Choudhri, E. U., Faruqee, H., & Hakura, D. S. (2005). Explaining the exchange rate pass-through in different prices. *Journal of International Economics*, *65*(2), 349–374. https://doi.org/10.1016/j.jinteco.2004.02.004
72. Christiano, L. . J. (2012). Christopher A. Sims and Vector Autoregressions. *The Scandinavian Journal of Economics*, *114*(4), 1082–1104. https://doi.org/10.1111/j.1467-9442.2012.01737.x
73. Clarida, R., Gali, J., & Gertler, M. (2001). Optimal Monetary Policy in Open versus Closed Economies: An Integrated Approach. *American Economic Review*, *91*(2), 248–252. https://doi.org/10.1257/aer.91.2.248
74. Colander, D. C. (1993). The Macrofoundations of Micro. *Eastern Economic Journal, Palgrave Macmillan Journals*, *19*(4), 447–457.
75. Corsetti, G., Dedola, L., & Leduc, S. (2005). *DSGE Models of High Exchange-Rate Volatility and Low Pass-Through* (Working Paper No. 3882341). https://papers.ssrn.com/abstract=3882341
76. Corsetti, G., Dedola, L., & Leduc, S. (2007). Optimal Monetary Policy and the Sources of Local-Currency Price Stability. In *International Dimensions of Monetary Policy: Vol. International Dimensions of Monetary Policy* (pp. 319–367). University of Chicago Press. https://www.nber.org/books-and-chapters/international-dimensions-monetary-policy/optimal-monetary-policy-and-sources-local-currency-price-stability

77. Coulibaly, D., & Kempf, H. (2010). *Does Inflation Targeting Decrease Exchange Rate Pass-Through in Emerging Countries?* (Working Paper No. 1706025). https://doi.org/10.2139/ssrn.1706025
78. Dacorogna, M., Gençay, R., Muller, U., Olsen, R., & Pictet, O. (2001). *An Introduction to High-Frequency Finance*. Academic Press, Elsevier.
79. Dash, A. K., & Narasimhan, V. (2011a). Exchange Rate Pass-through: How Much Do Exchange Rate Changes Affect the Prices of Indian Exports and Imports. *South Asia Economic Journal*, *12*(1), 1–23. https://doi.org/10.1177/139156141001200101
80. Dash, A. K., & Narasimhan, V. (2011b). Exchange Rate Pass-through: How Much Do Exchange Rate Changes Affect the Prices of Indian Exports and Imports. *South Asia Economic Journal*, *12*(1), 1–23. https://doi.org/10.1177/139156141001200101
81. De Grauwe, P. (1988). Exchange Rate Variability and the Slowdown in Growth of International Trade. *Staff Papers (International Monetary Fund)*, *35*(1), 63–84. https://doi.org/10.2307/3867277
82. de Mendonça, H. F., & Tiberto, B. P. (2017). Effect of credibility and exchange rate pass-through on inflation: An assessment for developing countries. *International Review of Economics & Finance*, *50*, 196–244. https://doi.org/10.1016/j.iref.2017.03.027
83. Department of Industrial Policy and Promotion, Ministry of Commerce and Industry, Department of Industrial Policy and Promotion, & Office of Economic Adviser,India. (2017). *Release Of New Series Of Wholesale Price Index/Frequently Asked Questions on Revision of Wholesale Price Index (Base 2011-12)* [Data set]. https://eaindustry.nic.in/uploaded_files/FAQs_on_WPI.pdf
84. Devereux, M. B. (1999). *Monetary Policy,Exchange Rate Flexibility, and Exchange Rate Pass-Through* [Bank of Canda Working Paper]. bankofcanada.ca/wp-content/uploads/2010/08/devereux.pdf
85. Devereux, M. B., & Yetman, J. (2010a). Price adjustment and exchange rate pass-through. *Journal of International Money and Finance*, *29*(1), 181–200. https://doi.org/10.1016/j.jimonfin.2008.12.009
86. Devereux, M. B., & Yetman, J. (2010b). Price adjustment and exchange rate pass-through. *Journal of International Money and Finance*, *29*(1), 181–200. https://doi.org/10.1016/j.jimonfin.2008.12.009
87. Devereux, M. B., Engel, C., & Storgaard, P. E. (2003). *Endogenous Exchange Rate Pass-through when Nominal Prices are Set in Advance* (Working Paper No. 9543). National Bureau of Economic Research. https://doi.org/10.3386/w9543

88. Dhal, S. (2011). Industry Effects of Monetary Transmission Mechanism in India: An Empirical Analysis of Use-based Industries. *Reserve Bank of India Occasional Papers*, *32*(2), 39–79.
89. Dhasmana, A. (2012). *India's Real Exchange Rate and Trade Balance: Fresh Empirical Evidence* (IIM Banglore Working Paper Series No. 2153401). Indian Institue of Mannagement Banglore (IIMB). https://doi.org/10.2139/ssrn.2153401
90. Dholakia, R. H. (1990). Extended Phillips Curve for the Indian Economy. *The Indian Economic Journal*, *38*(1), 69–78. https://doi.org/10.1177/0019466219900105
91. Dholakia, R. H., & Saradhi, R. V. (2000). Exchange Rate Pass-Through and Volatility: Impact on Indian Foreign Trade. *Economic and Political Weekly*, *35*(47), 4109–4116.
92. Diaconu, M. (2023). Obstacles to innovation and policy implications: Exploring the case of Romanian firms. *Theoretical and Applied Economics, Springer*, *30*(1 (634)), 5–20.
93. Dilla, S., Achsani, N. A., & Anggraeni, L. (2017). Do Inflation Targeting Really Reduced Exchange Rate Pass-through? *International Journal of Economics and Financial Issues*, *7*(3), 444–452.
94. Dixit, A. (1989). Hysteresis, Import Penetration, and Exchange Rate Pass-Through. *The Quarterly Journal of Economics*, *104*(2), 205–228. https://doi.org/10.2307/2937845
95. Dornbusch, R. (1976). Expectations and Exchange Rate Dynamics. *Journal of Political Economy*, *84*(6), 1161–1176.
96. Dornbusch, R. (1985). *Exchange Rates and Prices.* [NBER Working Paper,No. 1769]. https://www.nber.org/system/files/working_papers/w1769/w1769.pdf
97. Dornbusch, R. (1987). Exchange Rates and Prices. *The American Economic Review*, *77*(1), 93–106.
98. Dr. Arabi, U. (2012). *Foreign exchange market behaviuor and its management In the post-reform period: The indian experiences*.
99. Dr. Shanmugan, K. (2019). Directions of Foreign trade after liberalization in India: Bloc-wise analysis. *International Journal of Research in Social Sciences*, *8*(12), 261–270.
100. Dua, P., & Gaur, U. (2009). Determination of Inflation in an Open Economy Phillips Curve Framework: The Case of Developed and Developing Asian Countries. *Centre for Development Economics Working Paper No. 178*, 1–27.
101. Dua, P., & Goel, D. (2021). Determinants of Inflation in India. *Journal of Developing Areas, Tennessee State University*, *55*(2), 261–270.
102. Dua, P., & Ranjan, R. (2010a). *DRG Study on "Exchange Rate Policy and Modelling in India"* (Development Research Group Report No. 33; p. 96). Department of Economic

Analysis, Reserve Bank of India. https://www.rbi.org.in/Scripts/BS_PressReleaseDisplay.aspx?prid=22122

103. Dua, P., & Ranjan, R. (2010b). *Exchange Rate Policy and Modelling in India* [Working Paper]. Department of Economic Analysis and Policy, Reserve Bank of India.

104. Dwyer, J., Kent, C., & Pease, A. (1993). *Exchange Rate Pass-through: The Different Responses of Importers and Exporters* [Working Paper]. Reserve Bank of Australia. https://www.rba.gov.au/publications/rdp/1993/pdf/rdp9304.pdf

105. Echelon, E. (2013). EViews ® 8 Estimation · Forecasting · Statistical Analysis Graphics · Data Management · Simulation Users Guide I. *IHS Global Inc.*, *User Guide II*. https://www.academia.edu/35003056/EViews_8_Estimation_Forecasting_Statistical_Analysis_Graphics_Data_Management_Simulation_Users_Guide_I

106. Enders, A., Enders, Z., & Hoffmann, M. (2017). *International Financial Market Integration, Asset Compositions, and the Falling Exchange Rate Pass-Through* [Working paper,CESifo Working Paper Series 6483, CESifo.]. https://ideas.repec.org/p/ces/ceswps/_6483.html

107. Enders, A., Enders, Z., & Hoffmann, M. (2017). *International Financial Market Integration, Asset Compositions, and the Falling Exchange Rate Pass-Through* [CESifo Working Paaper Series, CESifo Working Paper No. 6483]. https://www.cesifo.org/en/publications/2017/working-paper/international-financial-market-integration-asset-compositions-and

108. Enders, W. (2014). *Applied Econometric Time Series* (4th Edition). John Wiley & Sons, Inc. https://www.wiley.com/en-us/Applied+Econometric+Time+Series%2C+4th+Edition-p-9781118808566

109. *Exchange Rate Pass-through and inflation trends in developing countries.* (2014). Global Economic Prospects.

110. Farhi, E., & Baqaee, D. (2023). *Macroeconomics as Explicitly Aggregated Microeconomics* [Working Paper]. https://www.nber.org/programs-projects/projects-and-centers/7803-macroeconomics-explicitly-aggregated-microeconomics?page=1&perPage=50

111. Favero, C. A., & Hendry, D. F. (1990). Testing the Lucas Critique: A Review. *Queen Mary University of London, School of Economics and Finance Working Papers No. 220*, Article 220. https://ideas.repec.org//p/qmw/qmwecw/220.html

112. Favero, C., & Hendry, F. D. (1992). Testing the lucas critique: A review. *Econometric Reviews*, *11*(3), 265–306. https://doi.org/10.1080/07474939208800238

113. Feenstra, R. C. (1987). *Symmetric Pass-Through of Tariffs and Exchange Rates under Imperfect Competition: An Empirical Test* [NBER Working Paper No. 2453, NBER, Cambridge, MA, December.].

114. Feenstra, R. C., Gagnon, J. E., & Knetter, M. M. (1993). *Market share and Exchange Rate Pass-Through in World of Automobile Trade* [NBER Working Paper No. 4399, NBER, Cambridge, MA, July].

115. Flaschel, P., Groh, G., Proaño, C., & Semmler, W. (2008). *Topics in Applied Macrodynamic Theory* (Vol. 10). Springer. https://doi.org/10.1007/978-3-540-72542-8

116. Forbes, K., Hjortsoe, I., & Nenova, T. (2017). *Shocks versus structure: Explaining differences in exchange rate pass-through across countries and time* [Bank of England, External MPC Unit, Working Paper No. 50]. Bank of England.

117. Forbes, K., Hjortsoe, I., & Nenova, T. (2018a). The shocks matter: Improving our estimates of exchange rate pass-through. *Journal of International Economics*, *114*, 255–275. https://doi.org/10.1016/j.jinteco.2018.07.005

118. Forbes, K., Hjortsoe, I., & Nenova, T. (2018b). The shocks matter: Improving our estimates of exchange rate pass-through. *Journal of International Economics*, *114*, 255–275. https://doi.org/10.1016/j.jinteco.2018.07.005

119. Forder, J. (2014). *Macroeconomics and the Phillips Curve Myth*. Oxford University Press.

120. Frankel, J. A., Parsley, D. C., & Wei, S.-J. (2005a). *Slow Passthrough Around the World: A New Import for Developing Countries?* (Working Paper No. 11199). National Bureau of Economic Research. https://doi.org/10.3386/w11199

121. Frankel, J. A., Parsley, D. C., & Wei, S.-J. (2005b). *Slow Passthrough Around the World: A New Import for Developing Countries?* [Working Paper series]. https://papers.ssrn.com/abstract=684725

122. Friedman, B. M., & Hahn, F. (Eds.). (1990). *Handbook of Monetary Economics: Vol. Vol 1*. Elsevier. https://econpapers.repec.org/bookchap/eeemonhes/1.htm

123. Friedman, M. (1953). The Methodology of Positive Economics. In *Essays in Positive Economics* (pp. 3–43). University of Chicago Press. https://philpapers.org/rec/FRITMO-3

124. Friedman, M. (1968). The Role Of Monetary Policy. *The American Economic Review*, *58*, 1–17.

125. Friedman, M. (1996). The Counter-Revolution in Monetary Theory. In G. E. Wood (Ed.), *Explorations in Economic Liberalism: The Wincott Lectures* (pp. 3–21). Palgrave Macmillan UK. https://doi.org/10.1007/978-1-349-24967-1_1

126. Frisch, H. (1984). Theories of inflation. United Kingdom: Cambridge University Press.1-262

127. Froot, K. A., & Klemperer, P. D. (1989). Exchange Rate Pass-Through When Market Share Matters. *The American Economic Review*, *79*(4), 637–654.

128. Gagnon, J. E., & Ihrig, J. (2004). Monetary policy and exchange rate pass-through. *International Journal of Finance & Economics*, *9*(4), 315–338. https://doi.org/10.1002/ijfe.253

129. Gali, J., & Monacelli, T. (2005). Monetary Policy and Exchange Rate Volatility in a Small Open Economy. *Review of Economic Studies*, *72*, 707–734.

130. Ghanem, D., & Smith, A. (2022). Causality in structural vector autoregressions: Science or sorcery? *American Journal of Agricultural Economics*, *104*(3), 881–904. https://doi.org/10.1111/ajae.12269

131. Ghate, C., Gupta, S., & Mallick, D. (2018a). Terms of Trade Shocks and Monetary Policy in India. *Computational Economics*, *51*(1), 75–121. https://doi.org/10.1007/s10614-016-9630-z

132. Ghate, C., Gupta, S., & Mallick, D. (2018b). Terms of Trade Shocks and Monetary Policy in India | SpringerLink. *Computational Economics*, *51*, 75–121. https://doi.org/10.1007/s10614-016-9630-z

133. Ghate, C., Pandey, R., & Patnaik, I. (2011). *Has India emerged? Business cycle facts from a transitioning economy* (pp. 1–26) [Woking Paper]. National Institute of Public Finance and Policy. https://www.nipfp.org.in/media/medialibrary/2013/04/wp_2011_88.pdf

134. Ghosh, A., & Rajan, R. S. (2007a). *A Selective Survey of Exchange Rate Pass-Through in Asia: What Does the Literature Tell Us?* (Colorado College Working Paper, 2007-01 No. 984063). https://doi.org/10.2139/ssrn.984063

135. Ghosh, A., & Rajan, R. S. (2007b). How high is exchange rate pass-through in India? Has it changed over time? *The Journal of International Trade & Economic Development, Routledge*, *16*(3), 373–382. https://doi.org/10.1080/09638190701526832

136. Ghosh, A., & Rajan, R. S. (2007c). How high is exchange rate pass-through in India? Has it changed over time? *The Journal of International Trade & Economic Development, Taylor and Francis, Routledge.*, *16*(3), 373–382. https://doi.org/10.1080/09638190701526832

137. Ghosh, A., & Rajan, R. S. (2007d). *Macroeconomic Determinants of Exchange Rate Pass-Through in India* (Working Paper No. 984332). Colorado College, Working Paper. https://doi.org/10.2139/ssrn.984332

138. Gil-Alana, L. A., & Gupta, R. (2019). Persistence, Mean Reversion and Nonlinearities in Inflation Rates of Developed and Developing Countries Using Over One Century of Data. *The Manchester School*, *87*(1), 24–36. https://doi.org/10.1111/manc.12213

139. Gillitzer. (n.d.). *Trade Invoicing Currency and First-stage Exchange Rate Pass-through*.

140. Glynn, J., Perera, N., & Verma, R. (2007). Unit root tests and structur oot tests and structural breaks: A sur eaks: A survey with applications y with applications. *University of Wollongong Research Online*, 2–17.

141. Goldberg, L. S., & Campa, J. M. (2010). The Sensitivity of the CPI to Exchange Rates: Distribution Margins, Imported Inputs, and Trade Exposure. *The Review of Economics and Statistics, The MIT Press*, *92*(2), 392–407.

142. Goldberg, P. K., & Hellerstein, R. (2008). A Structural Approach to Explaining Incomplete Exchange-Rate Pass-Through and Pricing-to-Market. *American Economic Review*, *98*(2), 423–429. https://doi.org/10.1257/aer.98.2.423

143. Goldberg, P. K., & Knetter, M. K. (1997). Goods Prices and Exchange Rates: What Have We Learned? *Journal of Economic Literature*, *35*(3), 1243–1272.

144. Goldfajn, I., & Werlang, S. R. da C. (2000). *The Pass-Through from Depreciation to Inflation: A Panel Study* (Working Paper No. 224277). DEPARTAMENTO DE ECONOMIA PUC-RIO, Banco Central de Brasil Working Paper No. 5. https://doi.org/10.2139/ssrn.224277

145. Gomes da Silva, C., & Reis Gomes, F. A. (2022). Using a consumption function to explain the Lucas Critique to undergraduate students. *EconomiA, 23*(1), 44–61. https://doi.org/10.1108/ECON-05-2022-0010

146. Gopinath, G. (2017). Dollar Dominance in Trade: Facts and Implications [India Exim Bank]. *EXIM Bank of India's 33rd Commencement Day Lecture.* https://www.eximbankindia.in/blog/blog-content.aspx?BlogID=9&BlogTitle=Dollar%20Dominance%20in%20Trade:%20Facts%20and%20Implications

147. Gopinath, G., & Rigobon, R. (2008). Sticky Borders. *The Quarterly Journal of Economics*, *123*(2), 531–575.

148. Gopinath, G., Itskhoki, O., & Rigobon, R. (2010). Currency Choice and Exchange Rate Pass-Through. *American Economic Review*, *100*(1), 304–336. https://doi.org/10.1257/aer.100.1.304

149. Gordon, R. J. (2011). The History of the Phillips Curve: Consensus and Bifurcation. *Economica*, *78*(309), 10–50. https://doi.org/10.1111/j.1468-0335.2009.00815.x

150. Gori, M. (2018). Chapter 2—Learning Principles. In *Machine Learning* (pp. 60–121). Morgan Kaufmann. https://doi.org/10.1016/B978-0-08-100659-7.00002-6

151. Gottschalk, J. (2001). *An Introduction into the SVAR Methodology: Identification, Interpretation and Limitations of SVAR models* (Kiel Working Papers 1072 No. 1072). Kiel Institute of World Economics (IfW), Kiel. https://ideas.repec.org//p/zbw/ifwkwp/1072.html

152. Goutsmedt, A., Pinzon-Fuchs, E., Renault, M., & Sergi, F. (2015). *Criticizing the Lucas Critique: Macroeconometricians' Response to Robert Lucas* (Preprint halshs-01179114). HAL Open Science. https://shs.hal.science/halshs-01179114

153. Goyal, A. (2012). India's fiscal and monetary framework: Growth in an opening economy. *Macroeconomics and Finance in Emerging Market Economies, 5*(1), 108–123. https://doi.org/10.1080/17520843.2011.605523

154. Goyal, A. (2014a). *External shocks* (pp. 1–27) [IGIDR Working Paper Series]. Indira Gandhi Institute of Development Research, Mumbai. http://www.igidr.ac.in/pdf/publication/WP-2014-046.pdf

155. Goyal, A. (2014b). *History of Monetary Policy in India Since Independence*. Springer India. https://doi.org/10.1007/978-81-322-1961-3

156. Goyal, A. (n.d.). *History of Monetary Policy in India since Independence* (pp. 1–60) [Working Paper]. Indira Gandhi Institute of Development Research, Mumbai. http://www.igidr.ac.in/pdf/publication/WP-2011-018.pdf

157. Goyal, A., & Arora, S. (2010). *The Indian exchange rate and central bank action: A GARCH analysis* (IGIDR Working Paper Series No. 2010–009). Indira Gandhi Institute of Development Research, Mumbai. https://ideas.repec.org//p/ind/igiwpp/2010-009.html

158. Green, H. A. J. (1977). Aggregation Problems of Macroeconomics. In G. C. Harcourt (Ed.), *The Microeconomic Foundations of Macroeconomics* (pp. 179–204). Palgrave Macmillan UK. https://doi.org/10.1007/978-1-349-03236-5_7

159. Green, H. A. J. (1977). Aggregation Problems of Macroeconomics. In G. C. Harcourt (Ed.), *The Microeconomic Foundations of Macroeconomics* (pp. 179–204). Palgrave Macmillan UK. https://doi.org/10.1007/978-1-349-03236-5_7

160. Greene, W. (2002). *ECONOMETRIC ANALYSIS*. Prentice Hall.

161. Gregorich, M., Strohmaier, S., Dunkler, D., & Heinze, G. (2021). Regression with Highly Correlated Predictors: Variable Omission Is Not the Solution. *International Journal of Environmental Research and Public Health*, *18*(8), 1–12. https://doi.org/10.3390/ijerph18084259

162. Grewal, H. S., & Trivedi, P. (2022). *Monetary Policy Independence under a Flexible Exchange Rate Regime – The Indian Case* [RBI Working Paper series, WPS (DEPR): 14 / 2022]. Reserve Bank of India. https://rbidocs.rbi.org.in/rdocs/Publications/PDFs/WPS14_21092022509020EDA16D4A3E86D7146CAB79F787.PDF

163. Gujarati, D. N., & Porter, D. C. (2008). *Basic Econometrics* (5th ed.). McGraw-Hill Education.

164. Gupta, A. S., & Sengupta, R. (2014). Is India Ready for Inflation-Targeting? *Munich Personal RePEc Archive (MPRA)*, *MPRA Paper No. 57463*, 1–31.

165. Guria, J. V., & Sokal, J. (2021). *Effective Exchange Rate Indices of the Indian Rupee*. Reserve Bank of India Bulletin 35-48. https://rbidocs.rbi.org.in/rdocs/Bulletin/PDFs/EBUL21012021_F5770050C073B4C99AD00DD0B520ABAAC.PDF

166. Gurusamy, J. (2013). *Impact of Exchange Rate on Trade and GDP for India A Study of Last Four Decade*. *2*(09), 154–171.

167. Ha, J., M.. Marc, S., & Yilmazkuday, H. (2019). *Inflation and exchange rate pass-through* [Policy Research Working Paper No. 8780,Macroeconomics, Trade and Investment Global Practice, World Bank Group.]. 1-42. http://www.worldbank.org/research.

168. Habermeier, K., Kokenyne, A., Veyrune, R., & Anderson, H. (2009). *Revised System for the Classification of Exchange Rate Arrangements* [IMF Working Paper, WP/09/211]. https://www.imf.org/en/Publications/WP/Issues/2016/12/31/Revised-System-for-the-Classification-of-Exchange-Rate-Arrangements-23311

169. Hałka, A., & Kotłowski, J. (2013). *Does domestic output gap matter for inflation in a small open economy?* (National Bank of Poland Working Paper, Narodowy Bank Polski. No. 152). Narodowy Bank Polski. https://doi.org/1-30

170. Hamilton, J. D. (2017). *Why You Should Never Use the Hodrick-Prescott Filter* (NBER Working Paper Series No. 23429). National Bureau of Economic Research 23429. https://doi.org/10.3386/w23429

171. Hardy, A. M. (1993). *Regression with Dummy Variables*. SAGE Publications, Inc. https://doi.org/10.4135/9781412985628

172. Hashimzade, N., & Thornton, M. A. (2013a). *Handbook of Research Methods and Applications in Empirical Macroeconomics*. Edward Elgar Publishing Limited. https://doi.org/10.4337/9780857931023

173. Hashimzade, N., & Thornton, M. A. (Eds.). (2013b). *Handbook of Research Methods and Applications in Empirical Macroeconomics*. Edwar Elagr Publishing Ltd. https://www.e-elgar.com/shop/gbp/handbook-of-research-methods-and-applications-in-empirical-macroeconomics-9781782545071.html

174. Hayat, A., & Katz, P. (2019). Investigating the Presence of a Nonlinear Exchange Rate Pass Through: A Markov Switching Model Approach. *Journal of Advances in Economics and Finance*, *4*(1), 29–37. https://doi.org/10.22606/jaef.2019.41004

175. Helmy, O., Fayed, M., & Hussien, K. (2018). Exchange rate pass-through to inflation in Egypt: A structural VAR approach. *Review of Economics and Political Science,Emerald Insight.*, *3*(2), 2–19. https://doi.org/10.1108/REPS-07-2018-001

176. Henry, H. (1984). *From Bretton Woods to World Inflation: A Study of Causes and Consequences* (1st ed.). https://mises.org/library/bretton-woods-world-inflation-study-causes-and-consequences

177. Hicks, J. R. (1937). Mr. Keynes and the "Classics"; A Suggested Interpretation. *Econometrica*, *5*(2), 147–159. https://doi.org/10.2307/1907242

178. Higham, N. J. (2009). Cholesky factorization. *WIREs Computational Statistics*, *1*(2), 251–254. https://doi.org/10.1002/wics.18

179. Hodrick, R. J., & Prescott, E. (1981). *Post-War U.S. Business Cycles: An Empirical Investigation* (Centre for Mathematical Studies in Economics and Management Sciences Working Papers 451 No. 451). Northwestern University, Center for Mathematical Studies in Economics and Management Science. https://ideas.repec.org//p/nwu/cmsems/451.html

180. Holland, M., Marçal, E., & de Prince, D. (2020). Is fiscal policy effective in Brazil? An empirical analysis. *The Quarterly Review of Economics and Finance*, *75*(February), 40–52. https://doi.org/10.1016/j.qref.2019.03.002

181. Humphrey, T. M. (1985). The early history of the Phillips curve. *Economic Review, Federal Reserve Bank of Richmond*, *71*(Sep), 17–24.

182. Huong, D. T. M., & Minh, CAO. H. (2019). Exchange Rate Pass-Through (ERPT) and its Implications for Vietnam: Vector Autoregressive Approach from Vietnam-Korea

Trade Data. *Asian Economic and Financial Review*, *9*(2), Article 2. https://doi.org/10.18488/journal.aefr.2019.92.257.266

183. Hutchison, M., Sengupta, R., & Singh, N. (2012). India's Trilemma: Financial Liberalisation, Exchange Rates and Monetary Policy. *The World Economy,Wiley Blackwell Publishing Ltd.*, *35*(1), 3–18. https://doi.org/j.1467-9701.2011.01381.x

184. Ihrig, J. E., Marazzi, M., & Rothenberg, A. D. (2006). *Exchange-Rate Pass-Through in the G-7 Countries* [Working Paper]. https://www.federalreserve.gov/econres/ifdp/exchange-rate-pass-through-in-the-g-7-countries.htm

185. Inoue, T. (2010). *Effectiveness of the monetary policy framework in present-day India: Have financial variables functioned as useful policy indicators* [Woking Paper]. Academic Research Repository at the Institute of Developing Economies. https://core.ac.uk/reader/288456750

186. Işik, C., Radulescu, M., & Fedajev, A. (2019). The effects of exchange rate depreciations and appreciations on the tourism trade balance: The case of Spain. *Eastern Journal of European Studies, Centre for European Studies, Alexandru Ioan Cuza University.*, *10(1)*, 221–237.

187. Ito, T., & Sato, K. (2008). Exchange Rate Changes and Inflation in Post-Crisis Asian Economies: Vector Autoregression Analysis of the Exchange Rate Pass-Through. *Journal of Money, Credit and Banking, Wiley, Ohio State University Press*, *40*(7), 1407–1438.

188. Ito, T., Sasaki, Y. N., & Sato, K. (2005). Pass-Through of Exchange Rate Changes and Macroeconomic Shocks to Domestic Inflation in East Asian Countries. *The Research Institue of Economy, Trade and Industry*, *RIETI Discussion Paper Series 05-E-020*, Article 05020.

189. Ivarola, L. (2018). A plea for realistic assumptions in economic modelling. *Theoria: An International Journal for Theory, History and Foundations of Science*, *33*(3), 417–433.

190. Jalil, A., & Rao, N. H. (2019). Chapter 8—Time Series Analysis (Stationarity, Cointegration, and Causality). In B. Özcan & I. Öztürk (Eds.), *Environmental Kuznets Curve (EKC): A Mannual* (pp. 85–99). Academic Press. https://doi.org/10.1016/B978-0-12-816797-7.00008-4

191. Jangili, R. (2011). Causal relationship between saving, investment and economic growth for India – what does the relation imply? *Reserve Bank of India Occasional Papers*, *32*(1), 25–39.

192. Jašová, M., Moessner, R., & Takáts, E. (2016). *Exchange rate pass-through: What has changed since the crisis?* [Working Paper Series]. Bank for International Settelments (BIS). https://www.bis.org/publ/work583.htm

193. Jha, R. (2008). Inflation targeting in India: Issues and prospects. *International Review of Applied Economics,Routledge*, *22*(2), 259–270. https://doi.org/10.1080/02692170701880783

194. Jhonson, H. G. (2013). *Essays in Monetary Economics (Collected Works of Harry Johnson)* (Vol. 3). Routledge, Taylor and Francis Group. https://www.routledge.com/Essays-in-Monetary-Economics-Collected-Works-of-Harry-Johnson/Johnson/p/book/9781032051376

195. John, J. (2015). Has inflation persistence in india changed over time? *The Singapore Economic Review, World Scientific Publishing Co.*, *60*(04), 1550095. https://doi.org/10.1142/S0217590815500952

196. Joseph, L. (N.A.). *Interactions in Multiple Linear Regression* [Document]. medicine.mcgill.ca/epidemiology/joseph/courses/EPIB-621/interaction.pdf

197. Joshi, A. R., & Acharya, D. (2011). Inflation Model for India in the Context of Open Economy. *South Asia Economic Journal*, *12*(1), 39–59. https://doi.org/10.1177/139156141001200103

198. Joshi, V. (2003). India and the Impossible Trinity. *The World Economy,Wiley Blackwell Publishing Ltd.*, *26*(4), 555–583. https://doi.org/10.1111/1467-9701.00537

199. Jouchi, N. (2011). Monetary Policy Transmission under Zero Interest Rates: An Extended Time-Varying Parameter Vector Autoregression Approach. *The B.E. Journal of Macroeconomics*, *11*(1), 1–24. https://doi.org/10.2202/1935-1690.2323

200. Junttila, J., & Korhonen, M. (2012). The role of inflation regime in the exchange rate pass-through to import prices. *International Review of Economics & Finance*, *24*, 88–96. https://doi.org/10.1016/j.iref.2012.01.005

201. Kabundi, A., & Mbelu, A. (2018). Has the Exchange Rate Pass-Through changed in South Africa? *South African Journal of Economics,Economic Society of South Africa*, *86*(3), 339–360. https://doi.org/doi: 10.1111/saje.12197

202. Kabundi, A., & Mlachila, M. (2019). The role of monetary policy credibility in explaining the decline in exchange rate pass-through in South Africa. *Economic Modelling*, *79*, 173–185. https://doi.org/10.1016/j.econmod.2018.10.010

203. Kalaba, R., & Tesfatsion, L. (1989). Time-varying linear regression via flexible least squares. *Computers & Mathematics with Applications*, *17*(8–9), 1215–1245. https://doi.org/10.1016/0898-1221(89)90091-6

204. Kamboj, P., & Tongia, R. (2018). *Indian Railways and Coal: An unsustainable interdependency* (pp. 9–52) [Brookings India report].

205. Kang, S., & Wang, Y. (2004). Fear of Inflation: Exchange Rate Pass-Through in East Asia. *The Korean Economic Review*, *20*(1), 193–211.

206. Kapur, M. and Patra, M, D. (2000). The Price of Low Inflation, Reserve Bank of India Occasional Papers, 21(2/3), pp. 191-233.

207. Kapur, M., & Behera, H. (2012a). Monetary Transmission Mechanism in India: A Quarterly Model. *RBI Working Paper Series*, *Paper No. 09*. https://mpra.ub.uni-muenchen.de/70631/

208. Kapur, M., & Behera, H. K. (2012b). *Monetary Transmission Mechanism in India: A Quarterly Model* (Monetary Transmission Mechanism in India: A Quarterly Model No. 2120792). https://doi.org/10.2139/ssrn.2120792

209. Karamelikli, H., & Korkmaz, S. (2016). The dynamics of exchange rate pass-through to domestic prices in Turkey. *Pressacademia*, *5*(1), 39–39. https://doi.org/10.17261/Pressacademia.2016116552

210. Kassi, D. F., Sun, G., Ding, N., Rathnayake, D. N., & Assamoi, G. R. (2019). Asymmetry in exchange rate pass-through to consumer prices: Evidence from emerging and developing Asian countries. *Economic Analysis and Policy*, *62*, 357–372. https://doi.org/10.1016/j.eap.2018.09.013

211. Kennedy, P. (2008). *A Guide to Econometrics* (6th Edition). Wiley-Blackwell. https://www.wiley.com/en-us/A+Guide+to+Econometrics%2C+6th+Edition-p-9781405182577

212. Khraief, N., Shahbaz, M., Mahalik, M. K., & Bhattacharya, M. (2021). Movements of oil prices and exchange rates in China and India: New evidence from wavelet-based, non-linear, autoregressive distributed lag estimations. *Physica A: Statistical Mechanics and Its Applications*, *563*, 125423. https://doi.org/10.1016/j.physa.2020.125423

213. Khundrakpam, J. (2007). Economic reforms and exchange rate pass-through to domestic prices in India. *BIS Working Papers, No. 225*, 1–29.

214. Khundrakpam, J. K. (2008). Have Economic Reforms Affected Exchange Rate Pass-Through to Prices in India? *Economic and Political Weekly*, *43*(16), 71–79.

215. Khundrakpam, J. K., & Jain, R. (2012). Monetary Policy Transmission in India: A Peep Inside the Black Box. *RBI WORKING PAPER SERIES*, *Working Paper No. 11*, 1–45. https://mpra.ub.uni-muenchen.de/51136/

216. Kim, H., Lin, Y., & Thompson, H. (2019). *Exchange Rate Pass-Through to Consumer Prices: The Increasing Role of Energy Prices* [Auburn University Department of Economics Working Paper Series, Working Paper No. AUWP 2019-01]. 1-20. https://cla.auburn.edu/econwp/index2019.html

217. Klein, L. R. (1958). The Estimation of Distributed Lags. *Econometrica*, *26*(4), 553–565. https://doi.org/10.2307/1907516

218. Kočenda, E., & Černý, A. (2015). *Elements of Time Series Econometrics: An Applied Approach—Karolinum*. Karolinum Press, Charles University Prauge. https://karolinum.cz/en/books/kocenda-elements-of-time-series-econometrics-an-applied-approach-15811

219. Koyck, L. M. (1954). Distributed Lags and Investment Analysis. Amsterdam, Netherlands: North-Holland.

220. Krishnamurty, K., & Pandit, V. (1996). Exchange Rate, Tariff and Trade Flows: Alternative Policy Scenarios for India. *Indian Economic Review*, *31*(1), 57–89.

221. Krishnaswamy, K. N., Sivakumar, A. I., & Mathirajan, M. (2012). *Management Research Methodology: Integration of Principles, Methods and Techniques*. Pearson.

222. Kumar, A. (2014). Exchange Rate Pass Through in India. *International Journal of Business and Management Invention*, *3*(2), 29–43.

223. Kumar, V., & Maurya, V. (2012). Is India's Trade Balance Sensitive to Real Exchange Rates? A Bilateral Trade Data Analysis. *Reserve Bank of India Occasional Papers*, *33*(1 and 2), 113–138.

224. Kumarl, R., & Pankaj, V. (2009). *The Global Economic Crisis: Impact on India and Policy Responses* (Working Paper No. 164). Asian Development Bank Institute (ADBI). http://www.adbi.org/working-paper/2009/11/12/3367.global.economic.crisis.india/

225. Kurtović, S., Siljković, B., Denić, N., Petković, D., Mladenović, S. S., Mladenović, I., & Milovancevic, M. (2018). Exchange rate pass-through and Southeast European economies. *Physica A: Statistical Mechanics and Its Applications*, *503*, 400–409. https://doi.org/10.1016/j.physa.2018.03.005

226. Kwiatkowski, D., Phillips, P. C. B., Schmidt, P., & Shin, Y. (1992). Testing the null hypothesis of stationarity against the alternative of a unit root: How sure are we that

economic time series have a unit root? *Journal of Econometrics*, *54*(1), 159–178. https://doi.org/10.1016/0304-4076(92)90104-Y

227. Laflèche, T. (1996). The impact of exchange rate movements on consumer prices. *Bank of Canada Review*, *Winter 1996-1997*, 21–32.

228. Laflèche, T. (1997). The impact of exchange rate movements on consumer prices. *Bank of Canada Review*, *1996–1997*(Winter), 21–32.

229. Laidler, D., & Parkin, M. (1975). Inflation: A Survey. *The Economic Journal*, *85*(340), 741–809. https://doi.org/10.2307/2230624

230. Larouche, L., & Goldman, D. (1980). *The Ugly Truth About Milton Friedman*. New Benjamin Franklin House Publishing Co. http://archive.org/details/the_ugly_truth_about_milton_friedman

231. Lavery, M. R., Acharya, P., Sivo, S. A., & Xu, L. (2019a). Number of predictors and multicollinearity: What are their effects on error and bias in regression? *Communications in Statistics - Simulation and Computation,Taylor and Francis*, *48*(1), 27–38. https://doi.org/10.1080/03610918.2017.1371750

232. Lavery, M. R., Acharya, P., Sivo, S. A., & Xu, L. (2019b). Number of predictors and multicollinearity: What are their effects on error and bias in regression? *Communications in Statistics - Simulation and Computation*, *48*(1), 27–38. https://doi.org/10.1080/03610918.2017.1371750

233. Lavery, M., Acharya, P., Sivo, S. A., & Xu, L. (2019). Number of predictors and multicollinearity: What are their effects on error and bias in regression? *Communications in Statistics - Simulation and Computation*, *48*(1), 27–38. https://doi.org/10.1080/03610918.2017.1371750

234. Levy-Yeyati, E. L., & Sturzenegger, F. (2000). *Classifying Exchange Rate Regimes: Deeds vs. Words* (SSRN Scholarly Paper No. 214428). https://doi.org/10.2139/ssrn.214428

235. Lim, C. H., & Papi, L. (1997). *An Econometric Analysis of the Determinants of Inflation in Turkey* [IMF Working Paper series, No. WP/97/170]. International Monetary Fund. https://www.imf.org/external/pubs/ft/wp/wp97170.pdf

236. Linde, J. (2001). Testing for the Lucas Critique: A Quantitative Investigation. *American Economic Review*, *91*(4), 986–1005. https://doi.org/10.1257/aer.91.4.986

237. Lindfield, G., & Penny, J. (2019). Chapter 2—Linear Equations and Eigensystems. In G. Lindfield & J. Penny (Eds.), *Numerical Methods:Using MATLAB,Academic Press* (Fourth Edition, pp. 73–156). Academic Press.

https://www.sciencedirect.com/science/article/pii/B9780128122563000117, Doi: DOI: 10.1016/B978-0-12-812256-3.00011-7

238. Little, D. (1982). Abstraction and Theory Marx's Method for Social Science. *The Southern Journal of Philosophy*, *20*(4), 441–452. https://doi.org/10.1111/j.2041-6962.1982.tb00311.x

239. Lopez-Villavicencio, A., & Mignon, V. (2016). *Exchange Rate Pass-through in Emerging Countries: Do the Inflation Environment, Monetary Policy Regime and Institutional Quality Matter?* [Woking Paper 2016-18]. CEPII Research Centre. https://economix-fr.translate.goog/documents-de-travail/exchange-rate-pass-through-in-emerging-countries-do-the-inflation-environment-monetary-policy-regime-and-institutional-quality-matter/?_x_tr_sl=fr&_x_tr_tl=en&_x_tr_hl=en&_x_tr_pto=sc

240. López-Villavicencio, A., & Pourroy, M. (2017). *IT Countries: A Breed Apart? the case of Exchange Rate Pass-Through* [Working Paper]. HAL Archive. https://shs.hal.science/halshs-01614817

241. Lucas, R. E. (1972). Expectations and the neutrality of money. *Journal of Economic Theory*, *4*(2), 103–124. https://doi.org/10.1016/0022-0531(72)90142-1

242. Lucas, R. E. (1973). Some International Evidence on Output-Inflation Tradeoffs. *The American Economic Review*, *63*(3), 326–334.

243. Lucas, R. E. Jr. (1976). Econometric policy evaluation: A critique. *Carnegie-Rochester Conference Series on Public Policy*, *1*, 19–46. https://doi.org/10.1016/S0167-2231(76)80003-6

244. Lucchetti, R., & Valentini, F. (2019). *Time-Varying OLS/IV estimators in gretl: The ketvals package* [Working Paper]. https://gretl.sourceforge.net/current_fnfiles/unzipped/ketvals.pdf

245. Luckstead, J. (2018). Asymmetric Exchange Rate Pass-Through In U.S. Imports Of Cocoa. *Journal of Agricultural and Applied Economics,Cambridge University Press*, *50*(3), 369–386. https://doi.org/10.1017/aae.2018.1

246. Lütkepohl, H. (2005). *New Introduction to Multiple Time Series Analysis* (1st ed.). Springer-Verlag Berlin Heidelberg 2005. https://doi.org/10.1007/978-3-540-27752-1

247. MacKinnon, J. G. (1996). Numerical Distribution Functions for Unit Root and Cointegration Tests. *Journal of Applied Econometrics*, *11*(6), 601–618.

248. Magee, S. P. (1973). Currency Con tracts, Pass-through, and Devaluation. *Brookings Papers on Economic Activity*, *1*, 303–325.

249. Majune, S. K. (2018). Theory and Practice of Testing for a Single Structural Break in Stata. *EconStor Preprints,172517, ZBW - Leibniz Information Centre for Economics*, Article 172517. https://ideas.repec.org//p/zbw/esprep/172517.html

250. Maka, E. (2013). Asymmetric Pass-Through of Exchange Rate Changes to CPI Inflation in Ghana. *International Journal of Economics, Finance and Management*, *2*(5), 338–350.

251. Mallick, S., & Marques, H. (2006). Sectoral Exchange Rate Pass-Through: Testing the Impact of Policy Reforms in India. *Scottish Journal of Political Economy*, *53*(2), 280–303. https://doi.org/10.1111/j.1467-9485.2006.00380.x

252. Mallick, S., & Marques, H. (2008). Exchange Rate Transmission into Industry-Level Export Prices: A Tale of Two Policy Regimes in India. *IMF Staff Papers*, *55*(01). https://doi.org/10.5089/9781589067226.024.A003

253. Mankiw, N. G. (1990). A Quick Refresher Course in Macroeconomics. *Journal of Economic Literature*, *28*, 1645–1660.

254. Mann, Catherine L. (1986), "Prices, Profit Margins and Exchange Rates," Federal Reserve Bulletin, 72 (June): 366-379.

255. Marazzi, M., & Sheets, N. (2007). Declining exchange rate pass-through to U.S. import prices: The potential role of global factors. *Journal of International Money and Finance*, *26*(6), 924–947. https://doi.org/10.1016/j.jimonfin.2006.12.003

256. Marston, R. C. (1989). *Pricing to Market in Japanese Manufacturing* [Working Paper]. National bureau of economic research. https://www.nber.org/system/files/working_papers/w2905/w2905.pdf

257. Marx, K. (1939). *Grundrisse: Foundations of the Critique of Political Economy*. Grundrisse, Penguin Books in association with New Left Review. https://www.marxists.org/archive/marx/works/1857/grundrisse/

258. Mazumder, S. (2011). The stability of the Phillips curve in India: Does the Lucas critique apply? *Journal of Asian Economics*, *22*(6), 528–539. https://doi.org/10.1016/j.asieco.2011.05.002

259. McCallum, B. T. (1990). Chapter 18 Inflation: Theory and evidence. In *Handbook of Monetary Economics* (Vol. 2, pp. 963–1012). Elsevier. https://doi.org/10.1016/S1573-4498(05)80025-6

260. Mendali, G., & Das, S. (2017). Exchange Rate Pass-through to Domestic Prices: The Indian Experience. *Foreign Trade Review, Sage Publications*, *52*(3), 135–156. https://doi.org/10.1177/0015732516650828

261. Menon, J. (1995). Exchange Rate Pass-Through. *Journal of Economic Surveys*, *9*(2), 197–231. https://doi.org/10.1111/j.1467-6419.1995.tb00114.x

262. Mihailov, A., Rumler, F., & Scharler, J. (2011). *The Small Open-Economy New Keynesian Phillips Curve: Empirical Evidence and Implied Inflation Dynamics* [Working Paper No. 817]. Johannes Kepler University of Linz, Department of Economics, Linz. https://ideas.repec.org//a/kap/openec/v22y2011i2p317-337.html

263. Mihaljek, D., & Klau, M. (2008). *Exchange rate pass-through in emerging market economies: What has changed and why?* [BIS Working Papers 35].

264. Ministry of Labour & Employment & Labour Bureau. (2020). *Report on New Series of Consumer Price Index for Industrial Workers (CPI-IW) (Base 2016 = 100)*.

265. Ministry of Labour & Employment, & Labour Bureau. (2020). *Report on New Series of Consumer Price Index for Industrial Workers (CPI-IW) (Base 2016 = 100)*.Government of India.

266. Mishkin, F. S. (1984). *The Causes of Inflation* [NBER Working Paper Series, Working Paper 1453]. National Bureau of Economic Research.

267. Mitra, A. K., Bhattacharya, I., Prabhu, E. A., Kavediya, R. B., Talwar, B. A., Kushawaha, K. M., & Kumar, A. (2021). *Chapter IV: Operating Procedure of Monetary Policy* (Report on Currency and Finance, RBI.; pp. 122–165). Reserve Bank of India. https://rbi.org.in/scripts/PublicationsView.aspx?Id=20345

268. Mohaddes, K., & Raissi, M. (2014). *Does Inflation Slow Long-Run Growth in India?* (Working Paper Series No. 1440). Cambridge University. https://ideas.repec.org//p/cam/camdae/1440.html

269. Mohanty, B., & Bhanumurthy, N. R. (2014). *Exchange rate regimes and inflation: Evidence from India* (NIPFP Working Paper No. 14/130). Exchange Rate Regimes and Inflation: Evidence from India. https://www.nipfp.org.in/media/medialibrary/2014/02/WP_2014_130.pdf

270. Mohanty, D. (2011). *How does the Reserve Bank of India Conduct its Monetary Policy?* (pp. 1–18) [Speech at Indian Institute of Management, Lucknow, India]. IIM Lucknow. https://www.bis.org/review/r110816a.pdf

271. Mohanty, D., & John, J. (2015). Determinants of inflation in India. *Journal of Asian Economics*, *36*, 86–96. https://doi.org/10.1016/j.asieco.2014.08.002

272. Monacelli, T. (2003). *Monetary policy in a low pass-through environment* [Working paper series]. European Central Bank. https://www.ecb.europa.eu/pub/pdf/scpwps/ecbwp227.pdf

273. Motyovszki, G. (2013). *The Evolution of Phillips Curve Concepts and Their Implications for Economic Policy* [Histroy of Economic Term Paper,]. Central European University. https://doi.org/10.13140/RG.2.2.24144.35841

274. Mukherjee, P., & Coondoo, D. (2019). The Indian Inflation 2006–2016: An Econometric Investigation. *South Asia Economic Journal, SAGE Publications India.*, *20*(1), 46–69. https://doi.org/10.1177/1391561418822205

275. Mumtaz, H., & Sunder-Plassmann, L. (2012). Time-Varying Dynamics of the Real Exchange Rate: An Empirical Analysis. *Journal of Applied Econometrics*, *28*(3), 498–525. https://doi.org/10.1002/jae.2270

276. Murad, S. M. W. (2022). The role of domestic and foreign economic uncertainties in determining the foreign exchange rates: An extended monetary approach. *Journal of Economics and Finance,Springer Link*, *46*(4), 666–677. https://doi.org/10.1007/s12197-022-09589-5

277. Mustafa, M., & Matiur, R. (2008). U.S. Bilateral Nominal Trade Balance with India, Japan, Malaysia, S. Korea and Thailand, and Bilateral Nominal Exchange Rate Dynamics: Evidence on J-Curve? *Southwestern Economic Review*, *35*.

278. Musti, B. M., & Siddiki, J. U. (2018). *Nonlinear and Asymmetric Exchange Rate Pass-Through to Consumer Prices In Nigeria: Evidence from a Smooth Transition Autoregressive Model* (Economics Discussion Paper 2018-3, Kingston University London. No. 2018–3). School of Economics, Kingston University London. https://ideas.repec.org//p/ris/kngedp/2018_003.html

279. Naqvi, B., & Rizvi, S. K. A. (2006). *Does exchange rate pass-through even exist in Asia or inflation targeting framework is irrelevant in its determination.* [Unpublished paper]. https://archivo.alde.es/encuentros.alde.es/anteriores/xiveea/trabajos/n/pdf/045.pdf

280. Nasir, M. A., Huynh, T., & Vo, X. V. (2019). Exchange Rate Pass-Through & Management of Inflation Expectation in a Small Open Inflation Targeting Economy. *SSRN Electronic Journal*, 28 Pages. https://doi.org/10.2139/ssrn.3377181

281. Nelson, C. R., & Plosser, C. R. (1982). Trends and random walks in macroeconmic time series: Some evidence and implications. *Journal of Monetary Economics*, *10*(2), 139–162. https://doi.org/10.1016/0304-3932(82)90012-5

282. Nerlove, M. (1958). *Distributed Lags and Demand Analysis for Agricultural and Other Commodities* (No. 316559). United States Department of Agriculture, Agricultural Marketing Service, Transportation and Marketing Program. https://ideas.repec.org//p/ags/uamstt/316559.html

283. O'Neill, R., Ralph, J., & Smith, P. (2017). Inflation: History and Measurement. In *Inflation: History and Measurement* (1st ed.). Palgrave Macmillan Cham. https://doi.org/10.1007/978-3-319-64125-6

284. Obstfeld, M. (2002). *Exchange Rates and Adjustment: Perspectives from the New Open Economy Macroeconomics* (Working Paper No. 9118). National Bureau of Economic Research. https://doi.org/10.3386/w9118

285. Obstfeld, M., & Rogoff, K. (2000). *The Six Major Puzzles in International Macroeconomics: Is There a Common Cause?* [Working Paper]. National Bureau of Economic Research. https://doi.org/10.3386/w7777

286. Obstfeld, M., & Rogoff, K. (2001). The Six Major Puzzles in International Macroeconomics: Is There a Common Cause? In *NBER Macroeconomics Annual 2000, Volume 15: Vol. Volume 15* (pp. 339–412). MIT Press. https://www.nber.org/books-and-chapters/nber-macroeconomics-annual-2000-volume-15/six-major-puzzles-international-macroeconomics-there-common-cause

287. Ocakverdi, E. (2019). *Time Varying Parameter estimation for OLS models*.

288. OECD. (2019). Trend estimation method. In *OECD Compendium of Productivity Indicators 2019*. Organisation for Economic Co-operation and Development. https://www.oecd-ilibrary.org/industry-and-services/oecd-compendium-of-productivity-indicators-2019_b2774f97-en

289. Ólafsson, T. T. (2006). *The New Keynesian Phillips Curve: In Search of Improvements and Adaptation to the Open Economy* [Central Bank of Iceland Working Papers, No.31]. https://core.ac.uk/download/pdf/6964461.pdf

290. Osabuohien, E., Obiekwe, E., Urhie, E., & Osabohien, R. (2018). Inflation rate, exchange rate volatility and exchange rate pass-through nexus the Nigerian experience. *Journal of Applied Economic Sciences*, *13*(Spring (2)), 574–585.

291. Ouliaris, Pagan, A. R., & Restrepo, J. (2018a). *Quantitative Macroeconomic Modeling with Structural Vector Autoregressions*. EViews. https://www.eviews.com/StructVAR/structvar.html

292. Ouliaris, S., Pagan, A., & Restrepo, J. (2018b). *Quantitative Macroeconomic Modeling with Structural Vector Autoregressions*. EViews. https://www.eviews.com/StructVAR/structvar.html

293. Ouyang, A. Y., & Rajan, R. S. (2016). Does Inflation Targeting in Asia Reduce Exchange Rate Volatility? *International Economic Journal, Routledge*, *30*(2), 294–311. https://doi.org/10.1080/10168737.2016.1148431

294. Ozkan, I., & Erden, L. (2015a). Time-varying nature and macroeconomic determinants of exchange rate pass-through. *International Review of Economics & Finance*, *38*, 56–66. https://doi.org/10.1016/j.iref.2015.01.007

295. Ozkan, I., & Erden, L. (2015b). Time-varying nature and macroeconomic determinants of exchange rate pass-through. *International Review of Economics & Finance*, *38*. https://doi.org/10.1016/j.iref.2015.01.007

296. Parab, P. (2022). Exchange rate pass-through in India. *Indira Gandhi Institute of Development Research, Mumbai Working Papers*, Article 2022–012. https://ideas.repec.org//p/ind/igiwpp/2022-012.html

297. Patnaik, I. (2003). *The consequences of currency intervention in India* [Working Paper]. Indian Council for Research on International Economic Relations. https://icrier.org/pdf/wp114.pdf

298. Patnaik, I., & Sengupta, R. (2021). *Analysing India's Exchange Rate Regime* [NIPFP Working Paper, No. 353]. https://www.nipfp.org.in/media/medialibrary/2021/09/WP_353_2021.pdf

299. Patnaik, I., Shah, A., & Veronese, G. (2011). *How to measure inflation in India?* [Woking paper]. National Institute of Public Finance and Policy,New Delhi. https://www.nipfp.org.in/media/medialibrary/2013/04/wp_2011_83.pdf

300. Patra, M. D., & Kapur, M. (2012a). A monetary policy model for India. *Macroeconomics and Finance in Emerging Market Economies,Routledge, Taylor and Francis.*, *5*(1), 18–41. https://doi.org/10.1080/17520843.2011.576453

301. Patra, M. D., & Kapur, M. (2012b). *Alternative Monetary Policy Rules for India* (IMF Working Paper No. 2127013). International Monetary Fund. https://papers.ssrn.com/abstract=2127013

302. Patra, M. D., & Pattanaik., S. (1994). Exchange Rate Pass Through and the Trade Balalnce:The Indian Experience. *Reserve Bank of India Occasional Papers*, *15*(4), 281–314.

303. Patra, M. D., & Ray, P. (2010). *Inflation Expectations and Monetary Policy in India: An Empirical Exploration* [IMF Working Paper, No. 2010/84]. imf.org/en/Publications/WP/Issues/2016/12/31/Inflation-Expectations-and-Monetary-Policy-in-India-An-Empirical-Exploration-23719

304. Patra, M. D., Kh u n d r a k p a m, J. K., & George, A. S. (2014). Post-Global Crisis Inflation Dynamics in India: What has Changed? *India Policy Forum 2013-14*, *10*, 117–203.

305. Patra, M. D., Khundrakpam, J. K., & John, J. (2018). *Non-Linear, Asymmetric and Time-Varying Exchange Rate Pass-Through: Recent Evidence from India* [RBI Working Paper Series (DEPR): 02/2018]. Reserve Bank of India. https://www.rbi.org.in/scripts/PublicationsView.aspx?Id=18106

306. Patra, M. D., Khundrakpam, J. K., & John, J. (2020). *Exchange Rate Pass-through in Emerging Economies* [RBI Working Paper Series 01/2020]. Reserve Bank of India, 1-23. https://www.rbi.org.in/Scripts/PublicationsView.aspx?id=19408

307. Patra, M., & Kapur, M. (2010). *A Monetary Policy Model Without Money for India* (pp. 1–64) [Woking Paper]. International Monetary Fund. https://doi.org/10.5089/9781455202171.001

308. Pattanaik, R. K., Kapoor, M., & Dhal, S. C. (2003). Exchange Rate Policy and Management:The Indian Experience. *EPW Special Articles*, *38*(22), 2139–2154.

309. Paul, B. P. (2009). In search of the Phillips curve for India. *Journal of Asian Economics*, *20*(4), 479–488.

310. Peer, A. H., & Baig, M. A. (2023). Inflation targeting and exchange rate pass-through in India: Lessons from international experience. *Theoretical and Applied Economics*, *30*(1(634), Spring), 239–254.

311. Peltzman, S. (2000). Prices Rise Faster than They Fall. *Journal of Political Economy,The University of Chicago Press*, *108*(3), 466–502. https://doi.org/10.1086/262126

312. Perron, P. (1989). The Great Crash, the Oil Price Shock, and the Unit Root Hypothesis. *Econometrica,Wiley, Econometric Society*, *57*(6), 1361–1401. https://doi.org/10.2307/1913712

313. Phelps, E. S. (1967). Phillips Curves, Expectations of Inflation and Optimal Unemployment over Time. *Economica*, *34*(135), 254–281. https://doi.org/10.2307/2552025

314. Phillips, A. W. (1958). The Relation between Unemployment and the Rate of Change of Money Wage Rates in the United Kingdom, 1861-1957. *Economica*, *25*(100), 283–299. https://doi.org/10.2307/2550759

315. Phillips, P. C. B. (1986a). Understanding spurious regressions in econometrics. *Journal of Econometrics*, *33*(3), 311–340. https://doi.org/10.1016/0304-4076(86)90001-1

316. Phillips, P. C. B. (1986b). Understanding spurious regressions in econometrics. *Journal of Econometrics*, *33*(3), 311–340. https://doi.org/10.1016/0304-4076(86)90001-1

317. Phiri, A. (2017). Inflation persistence in BRICS countries: A quantile autoregressive (QAR) model. *Munich Personal RePEc Archive (MPRA)*. https://mpra.ub.uni-muenchen.de/79956/

318. Phuc, N. V., & Duc, V. H. (2021). Macroeconomics Determinants of Exchange Rate Pass-Through: New Evidence from the Asia-Pacific Region. *Emerging Markets Finance and Trade,Tyalor and Francis, Routledge.*, *57*(1), 5–20. https://doi.org/10.1080/1540496X.2018.1534682

319. Pizzinga, A. (2012). *Restricted Kalman Filtering: Theory, Methods, and Application* (Vol. 12). Springer Science & Business Media.

320. Pizzinga, A. (2012). *Restricted Kalman Filtering: Theory, Methods, and Application* (Vol. 10). Springer Link. https://doi.org/10.1007/978-1-4614-4738-2

321. Pollard, P. S., & Coughlin, C. C. (2004a). *Size Matters: Asymmetric Exchange Rate Pass-Through at the Industry Level* (SSRN Scholarly Paper No. 716001). https://doi.org/10.2139/ssrn.716001

322. Pollard, P. S., & Coughlin, C. C. (2004b). *Size Matters: Asymmetric Exchange Rate Pass-Through at the Industry Level* (Working Paper No. 716001). https://doi.org/10.2139/ssrn.716001

323. Pollock, D. S. G. (2013). Filtering macroeconomic data. In N. Hashimzade & M. Thotnton, *Handbook of Research Methods and Applications in Empirical Macroeconomics* (pp. 95–136). Edward Elgar Publishing. https://ideas.repec.org//h/elg/eechap/14327_5.html

324. Pollock, D. S. G. (2013). *Filtering Macroeconomic Data*. University of Leicester. https://www.le.ac.uk/users/dsgp1/COURSES/LEIMETZ/ELGARTEXT.pdf

325. Przystupa, J., & Wróbel, E. (2011). Asymmetry of the Exchange Rate Pass-Through: An Exercise on Polish Data. *Eastern European Economics, Taylor & Francis, Ltd.*, *49*(1), 30–51.

326. Pyne, P. K., & Roy, S. S. (2008). *Exchange rate pass-through in india: An exploration with sectoral import prices* [Draft Paper]. http://www.igidr.ac.in/conf/money1/mfc-12/Pyne_Pradyut.pdf

327. Raj, J., Dhal, S., & Jain, R. (2008a). Reserve Bank of India—Database. *Reserve Bank of India Occasional Papers*, *29*(3), 69–117.

328. Raj, J., Dhal, S., & Jain, R. (2008b). Reserve Bank of India—Database. *Reserve Bank of India Occasional Papers*, *29*(3), 69–117.

329. Rajan, R. S., & Yanamandra, V. (2015a). *Managing the Macroeconomy: Monetary and Exchange Rate Issues in India*. Palgrave Macmillan London. https://link.springer.com/book/10.1057/9781137534149

330. Rajan, R. S., & Yanamandra, V. (2015b). *Managing the Macroeconomy: Monetary and Exchange Rate Issues in India* (First). Palgrave Macmillan London. DOI: https://doi.org/10.1057/9781137534149

331. Ramachandran, M., & Srinivasan, N. (2007). Asymmetric exchange rate intervention and international reserve accumulation in India. *Economics Letters*, *94*(2), 259–265. https://doi.org/10.1016/j.econlet.2006.06.040

332. Ranadive, R. R., & Burange, L. G. (2015a). Transmission Mechanism of Exchange Rate Pass-through in India. *Foreign Trade Review*, *50*(4), 263–283. https://doi.org/10.1177/0015732515598589

333. Ranadive, R. R., & Burange, L. G. (2015b). Transmission Mechanism of Exchange Rate Pass-through in India. *Foreign Trade Review*, *50*(4), 263–283. https://doi.org/10.1177/0015732515598589

334. Rangarajan, C., & Mishra, P. (2013). India's External Sector: Do We Need to Worry? *Economic and Political Weekly*, *48*(7), 52–59.

335. *RBI Report of The Expert Committee to Revise and Strengthen the Monetary Policy Framework* (pp. 1–121). (2014). Reserve Bank of India,Mumbai. https://rbidocs.rbi.org.in/rdocs/PublicationReport/Pdfs/ECOMRF210114_F.pdf

336. Rogoff, K. (2002). *Dornbusch's Overshooting Model after Twenty-Five Years* (IMF Working Paper No. 879418). https://papers.ssrn.com/abstract=879418

337. Romer, D. (1993). OPENNESS and Inflation: Theory and Evidence. *The Quarterly Journal of Economics*, *108*(4), 869–903.

338. Roy, S. S., & Pyne, P. K. (2011). Exchange Rate Pass-Through and India's Export Prices. *Trade and Development Review*, *4*(1), 41–63.

339. Rubio-Ramírez, J. F., Waggoner, D. F., & Zha, T. (2010). Structural Vector Autoregressions: Theory of Identification and Algorithms for Inference. *The Review of Economic Studies,Oxford University Press, Review of Economic Studies, Ltd.*, *77*(2), 665–696.

340. Saha, S., & Zhang, Z. (2011). Modelling Exchange Rate Pass-through in Australia, China and India. *Research Outputs 2011*, 1582–1588.

341. Saha, S., & Zhang, Z. (2013). Do exchange rates affect consumer prices? A comparative analysis for Australia, China and India. *Mathematics and Computers in Simulation*, *93*, 128–138. https://doi.org/10.1016/j.matcom.2012.11.002

342. Saha, S., & Zhang, Z. (2016a). Exchange rate pass-through and inflation in Australia, China and India: A comparative study with disaggregated data. *Journal of Economic Research*, *21*, 1–9.

343. Saha, S., & Zhang, Z. (2016b). Exchange rate pass-through and inflation in Australia, China and India: A comparative study with disaggregated data. *Journal of Economic Research*, *21*, 1–9.

344. Saha, S., & Zhang, Z. (NA). *Exchange Rate Pass-Through and it's Impact on Inflation: A Comparative Study for Australia, China and India with Disaggregated Data* [Perprint Article].

345. Sahoo, S. (2012). Volatility Transmission in the Exchange Rate of the Indian Rupee. *RBI WORKING PAPER SERIES*, *08*, 1–23.

346. Sargent, T. J., & Wallace, N. (1975). "Rational" Expectations, the Optimal Monetary Instrument, and the Optimal Money Supply Rule. *Journal of Political Economy*, *83*(2), 241–254.

347. Sarno, L., & Taylor, M. (2003). *The Economics of Exchange Rates* (1st ed.). Cambridge University Press. https://www.cambridge.org/core/books/economics-of-exchange-rates/F22FD7DD178640CED493AE33FA4EB3DD

348. Satyal, A. (2018). Exchange Rate Pass-through in India's Export Prices. *Journal of Business Thought*, *4*(April 2013-March 2014), 17–37.

349. Schlicht, E. (2020). *VC - A Method For Estimating TimeVarying Coefficients in Linear Models* [IZA Discussion Papers, No. 12920]. IZA Institute of Labour Economics. https://docs.iza.org/dp12920.pdf

350. Schlicht, E. (2021). VC: A method for estimating time-varying coefficients in linear models. *Journal of the Korean Statistical Society*, *50*(4), 1164–1196. https://doi.org/10.1007/s42952-021-00110-y

351. Schlicht, E. (2022a). *Estimating time-varying coefficients with Gretl using the VC method* (Vol. 1) [Munich Discussion Paper No. 2022-1]. Volkswirtschaftliche Fakultät Ludwig-Maximilians-Universität München. https://doi.org/10.5282/ubm/epub.34

352. Schlicht, E. (2022b). *Estimating time-varying coefficients with Gretl using the VC method (Version 1.2)*.

353. Seasholtz, M. B., & Kowalski, B. (1993). The parsimony principle applied to multivariate calibration. *Analytica Chimica Acta*, *277*(2), 165–177. https://doi.org/10.1016/0003-2670(93)80430-S

354. Sek, S. K., & Kapsalyamova, Z. (2008). Exchange rate pass-through and volatility: Impacts on domestic prices in four Asian countries. *Munich Personal RePEc Archive MPRA*, *11130*, 1–23.

355. Shah, A., & Patnaik, I. (2011). *India's Financial Globalisation* (Working Paper No. 1751417). International Monetary Fund. https://papers.ssrn.com/abstract=1751417

356. Sharma, S. (2011). *An Empirical Analysis of The Relationship between Currency Futures and Exchange Rates Volatility In India* [RBI Working Paper Series]. Reserve Bank of India. https://rbi.org.in/Scripts/PublicationsView.aspx?id=13323

357. Shioji, E. (2014). A Pass-Through Revival. *Asian Economic Policy Review*, *9*(1), 120–138. https://doi.org/10.1111/aepr.12053

358. Sims, C. A. (1980a). Macroeconomics and Reality. *Econometrica*, *48*(1), 1–48. https://doi.org/10.2307/1912017

359. Sims, C. A. (1980b). Macroeconomics and Reality. *Econometrica*, *48*(1), 1–48. https://doi.org/10.2307/1912017

360. Singh, K. (2006). Inflation Targeting: International Experience and Prospects for India. *Economic and Political Weekly*, *41*(27/28), 2958–2961.

361. Singh, K. B., Kanakaraj, A., & Sridevi, T. O. (2010). Revisiting the empirical existence of the Phillips Curve for India. *Munich Personal RePEc Archive(MPRA)*.

362. Singh, T. (2002). India's trade balance: The role of income and exchange rates. *Journal of Policy Modeling*, *24*(5), 437–452. https://doi.org/10.1016/S0161-8938(02)00124-2

363. Sohrabji, N. (2011). *Impact of Exchange Rates on Consumer Prices in India: Comparing Different Trade Liberalization and Monetary Policy Regimes* (Working Paper No. 1773932). SSRN. https://doi.org/10.2139/ssrn.1773932

364. Soon, S.-V., Baharumshah, A. Z., & Wohar, M. E. (2018). Exchange rate pass-through in the Asian countries: Does inflation volatility matter? *Applied Economics Letters*, *25*(5), 309–312. https://doi.org/10.1080/13504851.2017.1319553

365. Spescha, A. (2021). *False Feedback in Economics: The Case for Replication* (1st ed.). Taylor and Francis, Routledge. https://www.routledge.com/False-Feedback-in-Economics-The-Case-for-Replication/Spescha/p/book/9781032033723

366. Srimany, A. K., Gayen, S., & Ranjeev. (2011). *Effects of Recent Financial Crisis on Optimal Asset Allocation of Foreign Exchange Reserves* [RBI Working Paper series]. Reserve Bank of India. https://rbi.org.in/Scripts/PublicationsView.aspx?id=13580

367. Srinivasan, N., Mahambare, V., & Ramachandran, M. (2009). Preference asymmetry and international reserve accretion in India. *Applied Economics Letters, Routledge*, *16*(15), 1543–1546. https://doi.org/10.1080/13504850701578942

368. Srinivasan, P. V. (2004). *Managing price volatility in an open economy environment* [MTID DISCUSSION PAPER NO. 69]. IFPRI : International Food Policy Research Institute. https://www.ifpri.org/publication/managing-price-volatility-open-economy-environment

369. Stock, J. H., & Watson, M. W. (2001). Vector Autoregressions. *Journal of Economic Perspectives*, *15*(4), 101–115. https://doi.org/10.1257/jep.15.4.101

370. Stock, J. H., & Watson, M. W. (2017). Twenty Years of Time Series Econometrics in Ten Pictures. *Journal of Economic Perspectives*, *31*(2), 59–86. https://doi.org/10.1257/jep.31.2.59

371. Suryavanshi, S. (2022). Exchange Rate Pass-through in India. *Economic and Political Weekly*, *57*(49). https://www.epw.in/journal/2022/49/special-articles/exchange-rate-pass-through-india.html

372. Takhtamanova, Y. F. (2010). Understanding changes in exchange rate pass-through. *Journal of Macroeconomics*, *32*(4), 1118–1130. https://doi.org/10.1016/j.jmacro.2010.04.004

373. Tandrayen-Ragoobur, V., & Chicooree, A. (2013). Exchange Rate Pass Through to Domestic Prices: Evidence from Mauritius. *Journal of Economic Research (JER)*, *18*, 1–33. https://doi.org/10.17256/jer.2013.18.1.001

374. Taylor, J. B. (1993). Discretion versus policy rules in practice. *Carnegie-Rochester Conference Series on Public Policy ,Elsevier Science Publishers*, *39*, 195–214.

375. Taylor, J. B. (2000). Low inflation, pass-through, and the pricing power of firms. *European Economic Review*, *44*(7), 1389–1408. https://doi.org/10.1016/S0014-2921(00)00037-4

376. Thanabalasingam, V. (2014). Interpolating a low-frequency time to a high-frequency one: Programing and estimation procedure for matlab. *Sri Lanka Journal of Economic Research*, *2*, 93. https://doi.org/10.4038/sljer.v2i2.94

377. Thirwall, A. P. (1982). *Balance-of-Payments Theory and the United Kingdom Experience* (Second Edition). The Macmillan Press LTD. https://link.springer.com/book/10.1007/978-1-349-06534-9

378. Tinbergen, J. (1939). Method and its Application to Investment Activity

379. Tiwari, A., & Shahbaz, M. (2011). India's trade with USA and her trade balance: An empirical analysis. *Munich Personal RePEc Archive (MPRA)*, *Paper No. 29023*, 1–37.

380. Ullah, A., & Giles, David. E. A. (1998). *Handbook of Applied Economic Statistics* (Vol. 155). MarcelDekker INC. https://www.routledge.com/Handbook-of-Applied-Economic-Statistics/Ullah/p/book/9780367579371

381. Vernengo, M. (2007). Chapter 28: Money and Inflation. In P. Arestis & M. Sawyer (Eds.), *A Handbook of Alternative Monetary Economics* (pp. 471–489). Edward Elgar Publishing. https://econpapers.repec.org/bookchap/elgeechap/3506_5f28.htm

382. Webber, A. G. (1999). Dynamic and Long Run Responses of Import Prices to the Exchange Rate in the Asia-Pacific. *Asian Economic Journal*, *13*(3), 303–320. https://doi.org/10.1111/1467-8381.00087

383. Webber, A. G. (2000). Newton's gravity law and import prices in the Asia Pacific. *Japan and the World Economy*, *12*(1), 71–87. https://doi.org/10.1016/S0922-1425(99)00029-8

384. Winkler, O. W. (2009). *Interpreting Economic and Social Data: A Foundation of Descriptive Statistics* (1st ed., Vol. 16). Springer Berlin, Heidelberg.

385. Winkler, O. W. (2009). *Interpreting Economic and Social Data: A Foundation of Descriptive Statistics* (1st ed., Vol. 16). Springer Berlin, Heidelberg. https://doi.org/10.1007/978-3-540-68721-4

386. Yanamandra, V. (2014). *Essays on Monetary and Exchange Rate Effects in India* [Dissertation for degree of Doctor of Philosophy, George Mason University]. https://hdl.handle.net/1920/8906

387. Zanin, L., & Marra, G. (2011). Rolling Regression versus Time-Varying Coefficient Modelling: An Empirical Investigation of the Okun's Law in Some Euro Area Countries. *Bulletin of Economic Research*, *64*(1), 91–108. https://doi.org/10.1111/j.1467-8586.2010.00376.x

388. Zivot, E., & Andrews, D. W. K. (1992). Further Evidence on the Great Crash, the Oil Price Shock, and the Unit-Root Hypothesis. *Journal of Business and Economic Statistics*, *10*(3), 251–270.

389. Zivot, E., & Wang, J. (Eds.). (2006). Nonlinear Time Series Models. In *Modeling Financial Time Series with S-PLUS®* (pp. 653–712). Springer. https://doi.org/10.1007/978-0-387-32348-0_18

Notes

[i] Monthly data from 1993 onwards are available for this measure of import price variable. However, the empirical estimations undertaken using this variable provided theoretically inconsistent coefficients and the degree of pass-through appeared to be perverse from the economic theory point of view. There were several econometric problems encountered in employing this variable too. Thus, it was decided to not employ this measure and rather adhere to the annual data on unit value index from official sources in India.

[ii] Further details on the methodological issues and related aspects are elaborated in the next section as and where necessary.

[iii] Linearity in this context implies the linearity in parameters and not necessarily in the regressors.

[iv] However, an important feature of the Cholesky decomposition is that it imposes the exact number of restrictions required and thus always produces a 'just-identified' VAR.

[v] However, invertibility between the disturbances and structural shocks is critical in identifying the shocks. Analysts have pointed out that this may not always be the case.

[vi] A more survey of the identification issue, different identification strategies proposed in the VAR literature and their relative merits and demerits are contained in Christiano (2012).

[vii] All the variables are utilized in log difference form after adjustments for seasonality using X-13 ARIMA approach of the US Census Bureau.

[viii] However, a similar VAR was estimated using annual data and including import unit value index. The results were largely the same as reported in this section.

[ix] There are several oil markets globally. The market for OPEC-dominated sour grade crude oil, the sweet grade oil of US called the Brent crude are the most active markets. These markets tend to be interconnected from price determination point of view. The nature of oil pricing is thus complicated by such considerations and juxtaposing them as an endogenous to the pass-through mechanism seems difficult to justify.

[x] The traditional alternative to this approach is to specify the dummy variables as having value of 1.00 from the period when the intervention was introduced. Both the dummy variables were adopted in this manner also, and results remained very much the same. However, the coefficients of these two dummy variables were much more significant and slightly larger when used in the 'gradual intervention' approach.

[xi] This chapter employs the log difference in NEER to define the size and direction of exchange rate changes is undertaken to maintain congruence with the form of exchange rate variable used in previous chapters. Alternative approaches were also used, such as defining the dummy variables with Year-on-Year growth of NEER, but the results remained the same. Hence, the present approach has been adopted in this chapter.

[xii] Alternative definitions were also employed. Following Yanamandra (2014), change around the median was also used. Thereafter, 0.75 standard deviation change above and below the arithmetic mean was also utilized. The results remained largely similar.

[xiii] Kennedy (2008) provides a detailed account of the measurement and econometric issues in using interactive dummy variables in linear econometric models.

[xiv] The persistence in this context is defined rather broadly in terms of the significant lagged term of inflation rate in the equation specified for explaining its determinants. A more rigorous definition of inflation persistence should account for longer lags to assess the memory or the length of the persistence.

[xv] This is conditional upon the price elasticities of imports and exports. The fulfilment of the Marshall-Lerner condition is necessary to obtain these outcomes. The literature has generally indicated that the condition is fulfilled in the Indian context.

[xvi] As noted in chapter five, the forward-looking specifications were also tested for, but the bulk of the evidence pointed towards the backward-looking specification as being more relevant in explaining the variations in inflation.