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Original Research Article

Oil Rent, Inflation, and Exchange Rate in Iran

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For decades, debates surrounding the drivers of inflation and exchange rate fluctuations in Iran's economy have persisted. Despite this, a well-established and widely accepted theory among economists exists to explain long-term inflation. This study aims to demonstrate that natural resource rents, particularly oil rents, have partially bridged the aggregate demand-supply gap in the commodity market and the excess money supply gap during periods of increased real oil exports, primarily driven by favorable terms of trade for Iran. Consequently, this leads to two outcomes: first, inflation rates are lower than those implied by monetary theory, and second, exchange rate depreciation is less than what is predicted by monetary theory. Preliminary findings suggest that these two claims are plausible. Indeed, the core contribution of this study lies in providing a theoretical explanation and empirical analysis of the impact of oil rents on taming inflation and stabilizing exchange rates in Iran, consistent with established macroeconomic frameworks.

Keywords: Inflation, Exchange Rate, Monetary Model, Oil Rent, Money Demand
JEL Classification*:* E31, E52, F41, F31

1 Introduction

This study investigates the relationship between money demand, inflation, and oil rents in Iran, addressing the question: What is the relationship between money demand, inflation, and natural resource rents, particularly oil rents? Specifically, it explores why inflation and exchange rate[4] growth do not align with the predictions of the quantity theory of money and the monetary approach to exchange rate determination.

The primary objective of this study is to demonstrate that the divergence (or convergence) between the actual trend of the general price level and the

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[4] Throughout this paper, unless otherwise specified, the term "exchange rate" refers to the unofficial (free market) exchange rate for Iran, as reported by the Central Bank of Iran (CBI).

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price level consistent with the quantity theory of money is driven by increases (or decreases) in oil rents derived from oil exports. Similarly, the divergence (or convergence) between the actual trend of the exchange rate and the exchange rate predicted by the monetary model—manifested as slower exchange rate growth relative to money supply growth—is also rooted in increases (or decreases) in oil rents from oil exports.

Iran's economy has been intertwined with oil for nearly a century, a situation that has both elevated the level of welfare of Iranians compared to many countries and hindered significant welfare growth, leaving the economy grappling with persistent inflation. While oil has long been a cornerstone of Iran's economy, its transformative impact has been remarkable since the 1970s. A confluence of factors has fostered pervasive rent-seeking behavior, shaping the political economy of fiscal and monetary policymaking, which has culminated in a sustained inflationary environment. In other words, despite numerous structural changes in Iran's economy, the persistence of fiscal and monetary policies driving high money supply growth and high inflation has remained unaltered.

Since the 1970s, Iran's economy has distinctly entered a phase of entrenched inflationary conditions. However, the average inflation rate has been significantly lower than the difference between average money supply growth and average real GDP growth. Taking simple averages over the 64-year period from 1960 to 2023, money supply growth (broad money) averaged 25.27%, real GDP growth averaged 4.29%, and the consumer price index (CPI) inflation rate averaged 17.5%. According to the strict monetary model, widely accepted for explaining long-run inflation, the expected average inflation rate should approximate 21%. Yet, in practice, the realized average inflation rate was 17.5%, resulting in an annual inflation rate approximately 3.5% lower than predicted by the monetary model. Over the 64-year period, this translates to roughly 224% less cumulative inflation (using simple calculations) than what could have been expected. Compound growth calculations would yield even larger figures, but as the focus here is on the average difference between money supply growth and inflation, such calculations are omitted. It should be noted, however, that the CPI likely underestimates the general price level increase to some extent, which is beyond the scope of this study.

What explains Iran's lower-than-expected inflation relative to its money supply growth? While multiple explanations may exist, a convincing long-term account centers on the role of natural resource rents, particularly oil rents, with other natural resources gradually contributing as well. This study focuses

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on how, since the 1970s, widespread rent-seeking and government decisions on resource allocation have manifested in high money supply growth. These decisions have driven demand for goods and services far beyond supply, naturally exerting inflationary pressure. However, natural resource rents, which do not derive from domestic factors of production value added, have enabled Iran to capture part of the value added from the global economy, thereby mitigating some of the gap between aggregate demand and supply and alleviating part of the commodity market disequilibrium. Consequently, a portion of the inflationary pressure generated by government decisions has been exported to the global economy, resulting in realized inflation lower than what money supply growth would imply.

Furthermore, government decisions and the resultant money supply growth, in a context where Iran's major trading partners do not face similar conditions, have led to an excess supply in the domestic money market and excess demand in the foreign money (currency) market. Natural resource rents have constrained the growth of domestic money supply below what government expenditure decisions would otherwise entail, while also sustaining demand for domestic monetary assets beyond what would occur without such rents. Simultaneously, the availability of foreign monetary assets derived from natural resource rents has prevented the domestic currency from depreciating as much as government expenditure decisions would imply, or from experiencing exchange rate increases to the extent dictated by those decisions.

During periods when natural resource rents were substantial and terms of trade favored Iran’s economy, the role of these rents in narrowing the gap between aggregate demand and supply, as well as the gap between the supply and demand for domestic money, was particularly important. As a result, both inflation rates and exchange rate depreciation were, on average, lower. Conversely, when natural resource rents diminished (due to factors such as adverse terms of trade), the ability to bridge these gaps weakened, leading to higher inflation rates and more significant exchange rate increases.

The analysis suggests that to curb inflation, Iran's economy must prioritize restraining direct and indirect government expenditure directives reliant on money supply creation to prevent imbalances in the commodity and domestic monetary asset markets. This approach would, first, mitigate persistent pressure on the exchange rate and, second, allow natural resource rents to be channeled into various forms of investment, including foreign assets, to achieve higher returns and enhance the economy's resilience to terms-of-trade shocks. This is particularly critical for managing the foreign exchange market

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and exchange rates in a potential future scenario where sanctions are lifted. Until such a path is pursued, inflation and domestic currency depreciation will persist, while natural resource rents continue to be squandered.

To provide a comprehensive analysis, this paper is organized as follows. Section 2 presents a theoretical framework examining the role of government expenditure directives and money supply growth in creating imbalances in commodity and monetary asset markets, and how natural resource rents mitigate these imbalances. Section 3 provides empirical evidence, analyzing the impact of oil rents on inflation and exchange rates in Iran and other oil-exporting countries, using the monetary model and purchasing power parity frameworks. Section 4 reports the empirical findings from testing the study's hypotheses, employing an Autoregressive Distributed Lag (ARDL) model to assess the relationships between oil rents, inflation, and exchange rate deviations. Finally, Section 5 discusses the conclusions and policy implications, emphasizing the role of oil rents in stabilizing inflation and exchange rates and offering recommendations for fiscal and monetary policy to enhance long-term economic stability.

2 Government Expenditure Directives, Money Supply Growth, and Gaps in Commodity and Asset Markets

In the absence of a government and credit money creation, it is virtually impossible for persistent excess demand for goods and services to arise or for aggregate demand to consistently exceed aggregate supply. In a closed economy without a government, real aggregate demand for goods and services comprises household consumption and investment expenditures, while aggregate supply, or total real output, equates to the value added by factors of production involved in producing goods and services. The reason persistent excess aggregate demand cannot occur in this framework is that the source of purchasing power for consumption and investment expenditures derives from the income generated by the value added of production factors. This ensures that aggregate demand cannot consistently surpass aggregate supply, even if temporary imbalances are conceivable. Consequently, without persistent excess aggregate demand, significant and sustained inflation is unlikely to occur.

Now consider the introduction of a government in a closed economy. Assuming the government provides public goods and services without resource waste (an idealized benevolent government), it contributes to both the production and supply of goods and services and increases demand through government expenditures. In this scenario, absent credit money

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issuance, aggregate demand cannot exceed aggregate supply because government expenditures are financed through taxation, which is sourced from the value added of production factors, equivalent to the economy's total output or aggregate supply. Thus, persistent excess aggregate demand and sustained inflation remain implausible.

Next, consider a closed economy with a government where credit money issuance is possible. In this case, irrespective of the incentive structures underlying policy decisions, the government can issue expenditure directives or authorize expenditures financed not through taxation but through credit money creation. This clearly enables the aggregate demand for goods and services to exceed the aggregate supply, leading to price increases or inflation. Moreover, this policy approach can persist across periods, resulting in continuous excess aggregate demand and sustained price increases or inflation. In a closed economy without natural resource rents or the ability to appropriate goods and services of foreigners, repeated government expenditure directives reliant on money creation—manifested in high money supply growth relative to economic growth—generate high inflation, approximately equal to the difference between money supply growth and real economic growth. This occurs because government expenditure decisions, or delegated expenditure authorizations not financed through taxation, manifest as money supply growth, effectively creating aggregate demand equivalent to money supply growth, while aggregate supply grows in line with economic growth. This results in persistent excess demand, sustained inflation, and no escape unless the government curbs expenditure directives and limits money supply growth. It is important to note that government expenditure directives extend beyond explicit budgetary outlays. When the government permits a bank to bypass regulatory and accounting standards indicative of balance sheet health while continuing to extend loans, it effectively delegates expenditure authorization reliant on money creation by that bank. Additionally, this analysis can be framed within discussions of fiscal dominance and seigniorage.

Now consider an open economy without natural resource rents, such as oil. The inflationary outcome of government expenditure directives or delegated expenditure authorizations reliant on money creation does not fundamentally differ from that in a closed economy. A government may temporarily issue expenditure directives financed through money creation, creating excess aggregate demand and inflationary pressure. Other countries may lend to this government, allowing it to import goods and services to offset the excess demand and temporarily mitigate inflationary effects. However, this approach

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is unsustainable, as debt repayment requires the country to allocate part of its goods and services to external creditors, leading to intensified excess demand and inevitable price increases or inflation. This partially explains the initial suppression of inflation post-Iran-Iraq War and its resurgence in the early 1990s. Thus, even if a country expands aggregate demand through money creation and mitigates inflationary effects through external borrowing, these effects will appear with a delay, and long-term average inflation will approximate the difference between money supply growth and economic growth, even if inflation is temporarily tamed. Hence, in the long run, there is no escape from inflation driven by high money supply growth.

Now consider an open economy where government expenditure directives or delegated authorizations significantly exceed what the production and supply of goods and services permit, resulting in high money supply growth. However, assume this economy possesses natural resource rents, such as oil and gas. These rents, which are not part of the value added by domestic production factors, enable the country to appropriate a portion of the value added or output of other countries. Consequently, even if government expenditure directives generate aggregate demand far exceeding aggregate supply (accompanied by high money supply growth) the country can mitigate excess demand by appropriating foreign goods and services, thereby preventing price increases and inflation.

It is now necessary to scrutinize the political economy of direct and indirect government expenditure directives and their implications for the commodity market and domestic and foreign monetary asset markets. This analysis elucidates: (1) how natural resource rents can mitigate imbalances in the commodity and monetary asset markets, preventing significant inflation and exchange rate increases; and (2) how these mechanisms activate mechanisms that render the sustained use of natural resource rents for inflation and exchange rate control infeasible.

It is a fundamental principle that overt and covert budget deficits and resultant high money supply growth are not solely due to knowledge deficiencies but require a positive explanation. One such explanation for persistent overt and covert budget deficits and high money supply growth is the emergence of pervasive rent-seeking on both small and large scales. Small-scale rent-seeking manifests in the expansion of administrative structures, creating jobs with salaries and benefits disproportionate to their contribution to goods and services production, and providing subsidized goods and services (e.g., gasoline, water, electricity, gas, food) to a growing urban population to address social pressures. This has characterized Iran since the 1970s. Large-

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scale rent-seeking includes the proliferation of public works and development projects with costs exceeding standard pricing and market-based profits, generating rents for contractors and stakeholders, and providing subsidies (rents), particularly preferential foreign exchange and low-interest-rate bank loans, to businesses that would not exist without such support, under the guise of fostering development and employment. This has been Iran's economic reality since the 1970s, with variations in rent-seeking forms over time but an enduring overall structure. Some rent-seeking forms directly impact the government budget, overtly causing deficits and money supply growth, such as salary payments and project execution. Others deprive the government of revenue or delegate money creation authority, creating overt and covert deficits and money supply growth. For instance, historically, supplying gasoline or foreign exchange at below-market prices has reduced government revenue, leading to deficits. Similarly, providing low interest rate bank loans or permitting insolvent banks to operate delegates money creation authority, indirectly causing money supply growth akin to covert deficits.

Another critical point is that this analysis does not imply that money supply growth first occurs and then drives demand for goods and services and inflation. Many government expenditure directives or delegated authorizations directly generate demand for goods and services while simultaneously manifesting as money supply growth. For example, when the government and central bank permit an insolvent bank to continue operating, where the flow of deposit interest obligations exceeds the cash flow from loan and investment repayments, even without new loans, the bank adds to money supply by the difference between these flows, and depositors' interest income creates spending power and demand. This is not overtly tied to government budget deficits, but since the government authorizes the bank's continued operation, it effectively issues an expenditure directive, resembling a covert budget deficit.

Returning to the core issue, consider a static scenario at time t_0, where aggregate supply and demand are equal:

Sum of real value added (aggregate supply) = Sum of real total expenditures (aggregate demand) (1)

At time t_1, if government expenditure directives reliant on money creation increase aggregate demand before prices adjust, the following result emerges:

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Sum of real value added (aggregate supply) < Sum of real total expenditures (aggregate demand) (2)

Without natural resource rents, real excess aggregate demand is resolved through price increases, restoring equilibrium between real aggregate supply and demand. Alternatively, nominal value-added rises with prices until nominal aggregate supply equals increased nominal aggregate demand. In the long run, this implies price growth aligns with money supply growth in a static scenario.

For a country with natural resource rents, the following relationship can be introduced:

Natural resource rents + Sum of domestic production factors' value added = Capacity to supply goods and services

For countries without natural resource rents, the rent term is zero, and the capacity to supply goods and services equals the value added by domestic production factors. However, for a country with natural resource rents, this capacity exceeds domestic value added, as rents enable appropriation of foreign value added or output, mitigating inflationary pressures.

In an economy like Iran's, with significant natural resource rents from oil and gas, these rents—external to domestic value added—enable appropriation of foreign value added. This effectively increases real value added on the left-hand side of the above equation, mitigating part of the aggregate demand-supply imbalance and reducing price pressures. In the strict monetary model, natural resource rents augment output, preventing price increases proportional to money supply growth. As evidence, Figure 1 illustrates the ratio of inflation to money supply growth for 1960–2023. Except for the 1960s, when money supply growth was modest and real growth was high, resulting in a low inflation-to-money supply-growth ratio, Iran's experience from the 1970s onward shows significantly higher average money supply growth than output growth.

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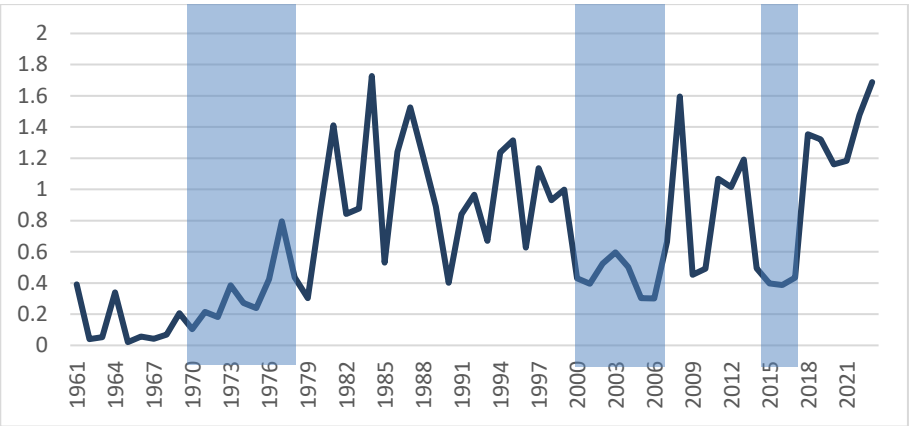

Figure 1. Ratio of Inflation to Broad money Growth, 1961–2023. Source: Author's calculations using data from the Central Bank of Iran

As Figure 1 clearly shows, excluding the 1960s, when money supply growth was low and real growth was high, periods with low inflation-to-money supply-growth ratios typically coincided with substantial oil revenues (notably the 1970s and 2000s). Additionally, in 2014–2017, high real interest rates, alongside improved foreign exchange revenues, contributed to low inflation and its ratio to money supply growth. For clearer evidence, in the 1990s and 2000s, annual average money supply growth was 27.1% and 28.1%, respectively, while the difference between money supply growth and inflation was 2.7% in the 1990s and 13.1% in the 2000s. This starkly illustrates the role of oil rents in mitigating inflation driven by money supply growth. While the significant exchange rate surge in the 1990s may partly explain this discrepancy, the exchange rate surge itself has a monetary explanation. As stronger evidence, during 1971–1978, with a fixed exchange rate, the difference between money supply growth and inflation reached 22.7%, only about 6% of which was attributable to real economic growth. Thus, the data robustly supports the claim that natural resource rents facilitated mitigation of aggregate demand-supply imbalances, reducing inflationary pressures.

Now consider the role of natural resource rents in addressing imbalances in domestic and foreign monetary asset supply and demand. In the monetary approach to the balance of payments, the foreign exchange market and exchange rate are analyzed as outcomes of the asset market.

Assume at time t_0, real domestic money supply and demand are equal:

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$$\mathrm{M}/P = \mathrm{L}(.) \tag{3}$$

where M/P is real money supply and $\mathrm{L}(.)$ is real domestic money demand, dependent on factors such as real domestic income. At time t_1, if government expenditure directives increase domestic money supply, the following inequality emerges:

$$\mathrm{M}/P > \mathrm{L}(.) \tag{4}$$

This indicates excess domestic money supply. To the extent that factors like real income growth increase real money demand, part of the increased money supply is absorbed, mitigating some imbalance. However, if government expenditure directives drive high money supply growth, the entire excess cannot be resolved this way. Since the monetary approach to the balance of payments extends monetary theory to an open economy and is suitable for the long run with flexible prices, the money market imbalance must be resolved even with high money supply growth. In a closed economy or an open economy without natural resource rents, this occurs through price increases, reducing real money supply. In an open economy with natural resource rents, money demand analyses suggest real money demand rises, reducing price pressures—an alternative perspective on how natural resource rents mitigate commodity market imbalances.

When government expenditure directives drive high domestic money supply growth, even if part of this is absorbed by increased money demand, excess demand for foreign money exerts fundamental pressure for exchange rate increases. With significant natural resource rents, the country can supply foreign exchange to the market, preventing exchange rate increases. Thus, during periods of abundant natural resource rents, high domestic money supply growth does not translate into much exchange rate pressures. This reinforces the earlier point that natural resource rents mitigate both commodity market imbalances, reducing price pressures, and monetary asset market imbalances, alleviating exchange rate pressures.

However, using natural resource rents to curb price and exchange rate growth activates mechanisms that preclude its indefinite sustainability. In the commodity market, using natural resource rents to suppress goods and services prices, increases demand for these subsidized items, exacerbating excess demand and intensifying inflationary pressures, which cannot be permanently eliminated. This explains the gradual intensification of inflationary pressures in the 1970s and 2000s. Additionally, the Dutch disease exacerbates this by weakening domestic tradable sector production.

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Simultaneously, this approach widens trade and capital account deficits, reducing balance-of-payments surpluses reliant on natural resource rents, increasing exchange rate pressures. Thus, fundamental forces driving exchange rate increases gradually materialize, undermining the ability to resolve commodity and foreign exchange market imbalances through natural resource rents. This becomes evident during periods of declining natural resource rents.

3 Empirical Evidence

This section examines the impact of oil rents on Iran's commodity and asset markets, as well as those of other oil-exporting countries. The objective is to empirically demonstrate how oil rents mitigate the inflationary effects of money supply growth. To achieve this, based on the monetary theory of exchange rates, the variables of inflation and money supply growth are analyzed within the framework of the purchasing power parity (PPP) exchange rate and the monetary model of exchange rate determination. The primary rationale for this approach is the critical role of the exchange rate channel in the relationship between money supply growth and inflation, as natural resource rents from oil exports influence inflation through their effect on exchange rates and, consequently, imports.

3.1 Monetary Theory and Exchange Rates

The monetary model of exchange rate determination is encapsulated in the PPP relationship (Equation 5), with the distinction that it treats this relationship as an equilibrium condition and considers the general price level as a function of the money supply-to-output ratio. In the monetary approach to the balance of payments, it is assumed that exchange rate growth aligns with domestic and foreign inflation, with both the exchange rate and the general price level being functions of the money supply-to-output ratio. Equation 6 presents a simplified form of the monetary model (see Mark, 1995; Mark & Sul, 2001; Rapach & Wohar, 2002), derived from the general equilibrium models of Lucas (1982) and Obstfeld & Rogoff (1995) (Rapach & Wohar, 2002).

$$E = P/P^* \tag{5}$$

$$E = \left({}^{M}/_{Y}\right)/\left({}^{M^*}/_{Y^*}\right) \tag{6}$$

Here, E denotes the exchange rate, ${}^{M}/_{Y}$ represents the money supply-to-GDP ratio at constant prices, and the superscript (*) refers to the foreign

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country (United States). Assuming the velocity of money is constant domestically and abroad, the monetary model's exchange rate can be viewed as a combination of the quantity theory of money and the PPP relationship (as an equilibrium condition). Figures 2 and 3 empirically demonstrate that Equations 5 and 6, supporting the monetary theory, hold in the long run.

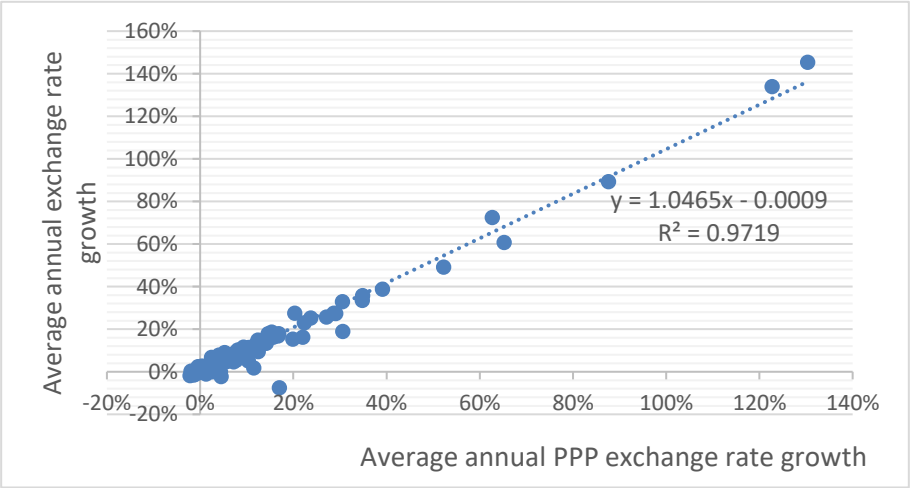

Figure 2. Relationship between Exchange Rate Growth and PPP Exchange Rate Growth, 1980–2021, for 153 Countries. The figure is sourced from Darabi (2024).

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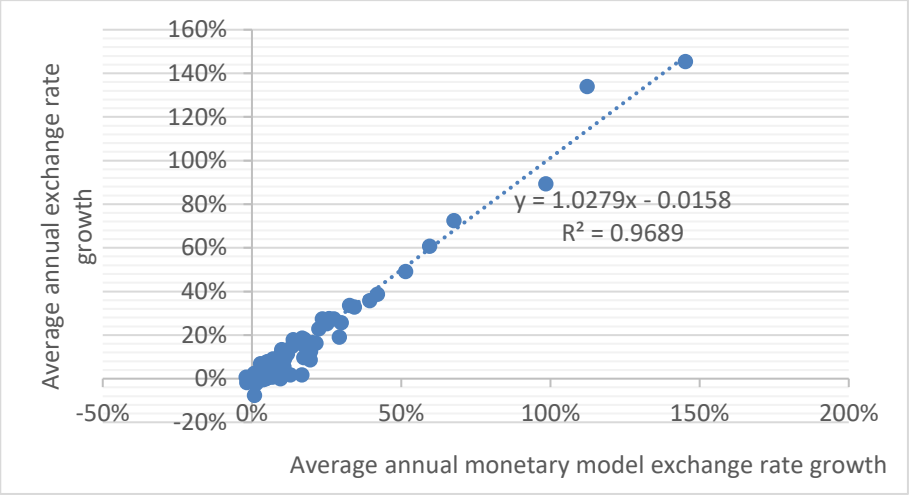

Figure 3. Relationship between Average Annual Exchange Rate Growth and Monetary Model Exchange Rate Growth, 1980–2021, for 153 Countries. The figure is sourced from Darabi (2024).

3.2 Money Supply, General Price Level, and Exchange Rate in Iran

According to monetary theory and consistent with the empirical evidence in Figures 2 and 3, the exchange rate trend in Iran is expected to align with the PPP exchange rate and the monetary model exchange rate. This alignment occurs when the trends of the general price level and the exchange rate, within the monetary approach and quantity theory framework, are proportional to money supply growth. To investigate this alignment, Figure 4 is utilized.

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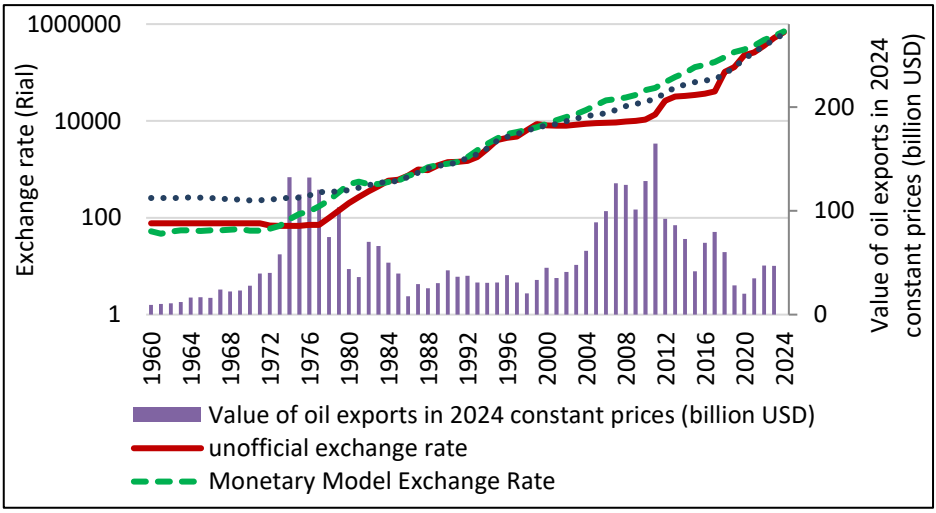

Figure 4. Annual Trends of Unofficial Exchange Rate, Monetary Model Exchange Rate, PPP Exchange Rate, and Real Value of Oil Exports in Iran. The figures are calculated and plotted using data from the Central Bank of Iran and the World Bank. The year 1991 is selected as the base year. Source: Author's calculations using data from the Central Bank of Iran and World Bank

The behavior of the three trends—exchange rate, PPP exchange rate, and monetary model exchange rate—across different periods provides significant insights into the exchange rate, general price level, and money supply, as discussed below.

1960–1971, Bretton Woods System. During this period, the exchange rate, PPP exchange rate, and monetary model exchange rate trends remain stable, indicating proportional growth in money supply, inflation, and the exchange rate. In other words, the monetary perspective on inflation and exchange rates holds. One might question why, despite the explanations in the previous section, the monetary theory explains inflation and exchange rates during this period despite rising real oil export values. The explanation lies in the fact that, as our explanation suggests, deviations between money supply growth, the rate of inflation, and the exchange rate growth arise from changes in the level of natural resource rents. However, the growth in oil exports during this period stemmed from increased oil production rather than oil prices. Thus, this growth in oil exports was driven by production factors.

1972–1983, Nixon Shock and Oil Price Surge. Following the Nixon Shock and the onset of the Bretton Woods system's collapse in 1971,

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alongside rising real oil prices (Figure 6), the real value of Iran's oil exports exhibited an upward trend. The primary driver of this increase was the rise in global oil prices, meaning that production factors played a minimal role, and much of the growth in real oil export value can be considered equivalent to growth in natural resource rents. During this period, the monetary model exchange rate grew significantly faster than the actual exchange rate and the PPP exchange rate, indicating that despite high money supply growth, the exchange rate and prices experienced limited growth. This phenomenon supports the hypothesis from the previous section, where increased natural resource rents from oil exports mitigated the inflationary effects of money supply growth. Due to oil-related foreign exchange inflows, money supply growth did not translate into exchange rate increases, resulting in significantly lower general price level growth relative to money supply growth.

1984–2000, Stable Real Oil Prices. During this period, real oil prices declined and stabilized at a new level compared to the pre-1973 surge, reaching approximately $40 per barrel in 2024 constant prices. According to Figure 4, the real value of Iran's oil exports averaged around $35 billion during this period. The exchange rate, PPP exchange rate, and monetary model exchange rate trends aligned closely, indicating that exchange rate growth, inflation, and money supply growth were proportional and consistent with the monetary theory. This alignment supports the hypothesis from the previous section, as the absence of significant changes in natural resource rents (due to stable oil exports) resulted in inflation and exchange rate growth consistent with money supply growth and monetary analysis. As shown in Figure 5, this behavior of exchange rate, price level, and money supply trends is not unique to Iran but is observed in 26 major oil-exporting countries.

2001–2011, Rising Real Value of Oil Exports. The real value of oil exports rose in line with global oil price increases in the 2000s, corresponding to the 2000s in Iran. The divergence between the exchange rate, PPP exchange rate, and monetary model exchange rate during this period indicates that, similar to the 1970s oil export surge, inflation and exchange rate growth were significantly lower than money supply growth. As observed in Figure 5, this pattern holds for other oil-exporting countries. This supports the study's hypothesis, as increased natural resource rents from oil exports reduced the proportional impact of money supply growth on inflation and exchange rate growth. Higher inflation relative to exchange rate growth stems from non-tradable goods, whose prices cannot be stabilized through imports.

2012, Exchange Rate Surge. Due to sanctions and the halt in the growth of real oil export value, followed by its decline due to reduced export volumes,

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the exchange rate experienced a significant surge. Although this surge increased inflation and reduced the divergence between the trends of money supply, the general price level, and the exchange rate, the gap persisted. The persistence of this gap is due to the fact that, despite reduced oil exports, their value remained higher than the 1980s and 1990s. In other words, oil-related natural resource rents in 2012 were still higher than in those decades, preventing full convergence of the exchange rate, PPP exchange rate, and monetary model exchange rate, unlike the 1980s and 1990s. Notably, the average real value of oil exports in 2012–2014 was nearly double that of the 1980s and 1990s. The behavior of money supply, the general price level, and the exchange rate in this year supports the study's hypothesis, as reduced natural resource rents narrowed the gap between money supply, price level, and exchange rate trends, but the gap did not close entirely due to rents remaining above the levels of the 1980s and 1990s. Similarly, as shown in Figure 5, 26 oil-exporting countries experienced a comparable pattern following the 2015 global oil price decline.

2013–2017, Significant Increase in Real Deposit Interest Rates. During this period, the average real value of oil exports remained approximately double that of the 1980s and 1990s, indicating higher natural resource rents. Additionally, from mid-2012, due to reduced inflationary expectations and banks' competition for deposits as a result of the banking crisis, real deposit interest rates reached high levels. Thus, the divergence between the three trends during this period was not solely due to higher oil rents compared to the 1980s and 1990s; high real deposit interest rates played a significant role in amplifying this divergence. Part of the inflationary effect of aggregate demand growth (money supply growth) was exported abroad, and part was deferred to the future through high real interest rates. Without these high real interest rates, the 2015 oil price decline, stabilizing at approximately $80 per barrel in 2024 constant prices (Figure 6), would have led to convergence of the exchange rate and PPP exchange rate in Iran, as observed in other oil-exporting countries (Figure 5). From 2015, the exchange rate and PPP exchange rate trends in oil-exporting countries converged and nearly aligned. The continued divergence between the monetary model exchange rate and the actual exchange rate is due to the permanently higher real oil prices and, consequently, real oil export values compared to the decades before 2000.

2018–2024, Decline in Real Oil Export Value and Real Deposit Interest Rates. During this period, the real value of oil exports returned to the levels of the 1980s and 1990s. With the decline in real oil export value to those levels and the absence of high real deposit interest rates, the exchange rate and PPP

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exchange rate converged toward the monetary model exchange rate. Consequently, from 2018 to 2024, price index growth and exchange rate growth significantly outpaced money supply growth. This observation supports the study's hypothesis, as the reduction in natural resource rents from 2018 to the levels of the 1980s and 1990s led to the convergence of the exchange rate, PPP exchange rate, and monetary model exchange rate trends. This implies that the lag in price level and exchange rate trends relative to money supply, driven by increased natural resource rents in the 2000s, began to catch up after 2018. This does not negate the impact of inflation and exchange rate growth on money supply growth but emphasizes their long-term alignment.

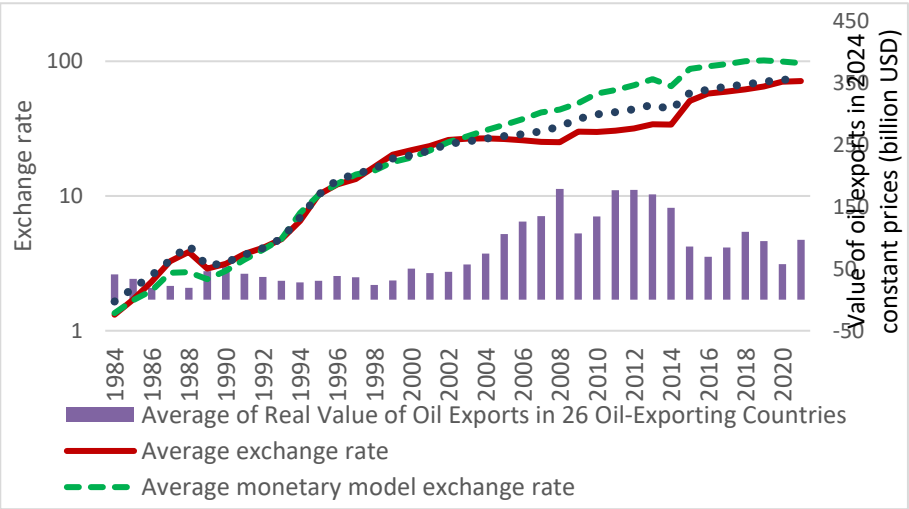

Figure 1. Average Trends of Exchange Rate, Monetary Model Exchange Rate, PPP Exchange Rate, and Real Value of Oil Exports in 26 Oil-Exporting Countries (1984–2021). The figure is sourced from Darabi (2024). The figures are calculated and plotted using data from OPEC and the World Bank. Averages are weighted geometrically, with each country's share based on production volume. The year 1991 is selected as the base year.

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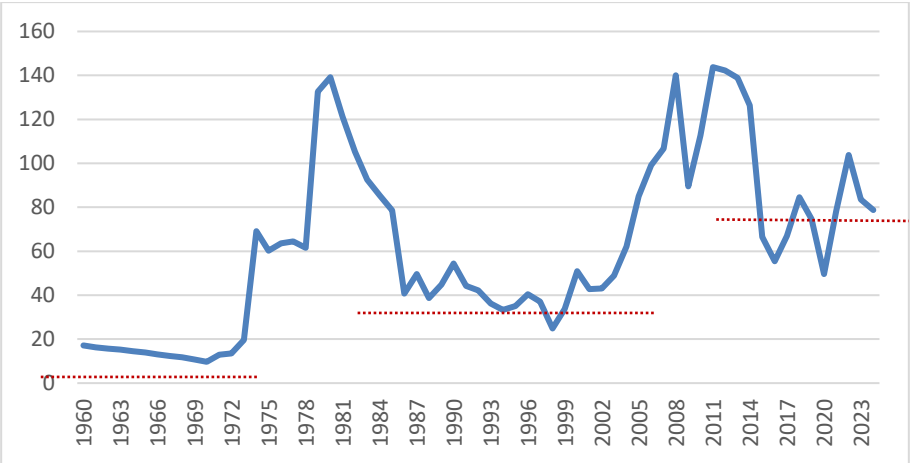

Figure 2. Annual Trend of Real Oil Price in 2024 Constant Prices (USD per Barrel), 1960–2024. The figure is sourced from Darabi (2024). The charts are calculated and plotted using World Bank data on average crude oil prices and U.S. CPI data from the World Bank.

3.3 Violation of the Monetary Approach Due to Natural Resource Rents

Thus far, it has been demonstrated that changes in the level of oil-related natural resource rents entering Iran's economy cause the exchange rate and general price level trends to deviate from the monetary theory. This deviation is observed in the divergence and convergence of the exchange rate, PPP exchange rate, and monetary model exchange rate trends. The monetary model expects long-term alignment of the exchange rate and PPP exchange rate with the monetary model exchange rate, an expectation not met in Iran or 26 other oil-exporting countries. The simple monetary model of exchange rate determination relies on two key assumptions: the validity of the PPP relationship and a stable money demand function, both of which Darabi (2024) show are not upheld in Iran and oil-exporting countries.

The PPP relationship, as an equilibrium condition, implies that exchange rate growth equals the difference between domestic and foreign inflation, meaning the real exchange rate in Iran should be stationary. As shown in Figure 7, the real exchange rate exhibits significant level shifts across periods, strongly correlated with the terms of trade (TOT). As Caves et al. (2007) note the primary driver of permanent real exchange rate level changes in oil-

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exporting countries is permanent changes in the terms of trade due to shifts in real oil prices or real oil export values. Increased oil exports, through permanent terms-of-trade changes, lead to permanent inflation level shifts. As is evident in Figure 8, the primary driver of terms-of-trade level shifts is the real value of oil exports. The disconnection between the terms of trade and the real exchange rate in 2014–2017 is attributed to high real deposit interest rates, which Rogoff (1996) identifies as a factor violating the PPP relationship. Thus, the PPP assumption of the monetary theory is violated due to changes in oil-related natural resource rent levels. The correlation between real exchange rate level shifts and oil export values further supports the study's hypothesis.

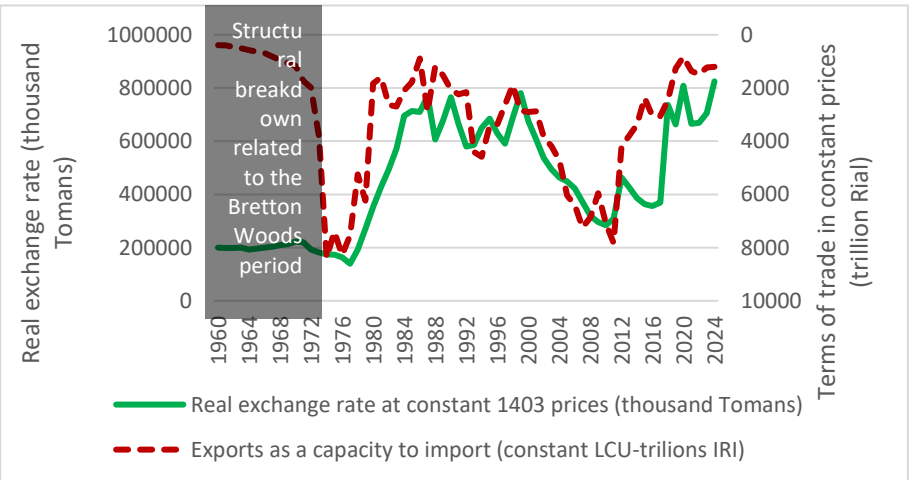

Figure 3. Real Exchange Rate in 2024 Constant Prices and Inverse Income Terms of Trade. The charts are plotted using data from the Central Bank of Iran and the FRED database. Income terms of trade refer to the import capacity generated by a given export volume. Increased oil exports enable greater imports without additional value added. The real exchange rate is calculated as: $Real\ Exchange\ Rate_t = Nomianl\ Exchange\ Rate_t \times \frac{CPI_t^{us}}{CPI_t^{IR}} \times \frac{CPI_{2024}^{IR}}{CPI_{2024}^{US}}$.

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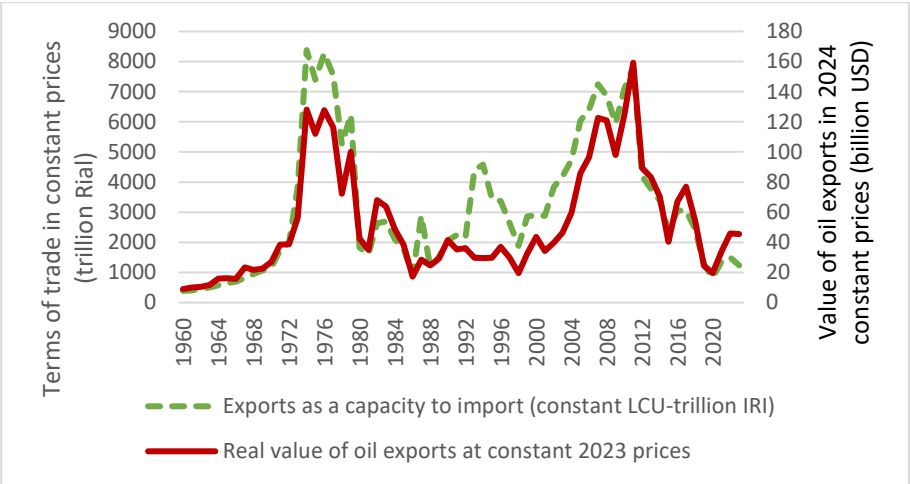

Figure 4. Real Value of Oil Exports in 2023 Constant Prices and Income Terms of Trade. Oil export data are sourced from the Central Bank's BOP, deflated using U.S. CPI from the World Bank. Terms-of-trade data are from the World Bank.

Another assumption of the monetary model is a stable money demand function (see Rapach & Wohar, 2002; Rapach & Wohar, 2004; Salvatore, 2013). As Hasanov et al. (2022) note, changes in oil price levels contribute to money demand function instability in oil-exporting countries. They demonstrate that money demand in Saudi Arabia is affected by real oil price changes. Figures 9 and 10 display the trends of real money balances (real broad money volume) alongside the real value of oil exports during the oil price and export surges in the 1970s and 2000s. Following the 1973 oil price increase, real broad money grew at a steeper rate than previously. With the decline in oil export value from 1978, real money growth stalled and stabilized. Had price growth exceeded money growth after the oil export decline, real money balances would have decreased. Notably, the 16% average growth in real money balances from 1960–1973 was largely driven by 12% average real output growth, with oil production rising from 1 million to over 5 million barrels per day playing a significant role. From the monetary theory of inflation, long-term real money balance growth aligns with real output growth. With rising oil export values in the early 2000s, real money balances resumed an upward trend, which halted with sanctions and inflationary expectations from 2011 but resumed after 2014 due to high real deposit

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interest rates in 2014–2017. In both periods of oil export surges (1970s and 2000s), Iran's real broad money levels increased permanently, far exceeding GDP growth, indicating a violation of the stable money demand function assumption. As noted earlier, increased oil-related natural resource rents drove higher real money demand in the 1970s and 2000s.

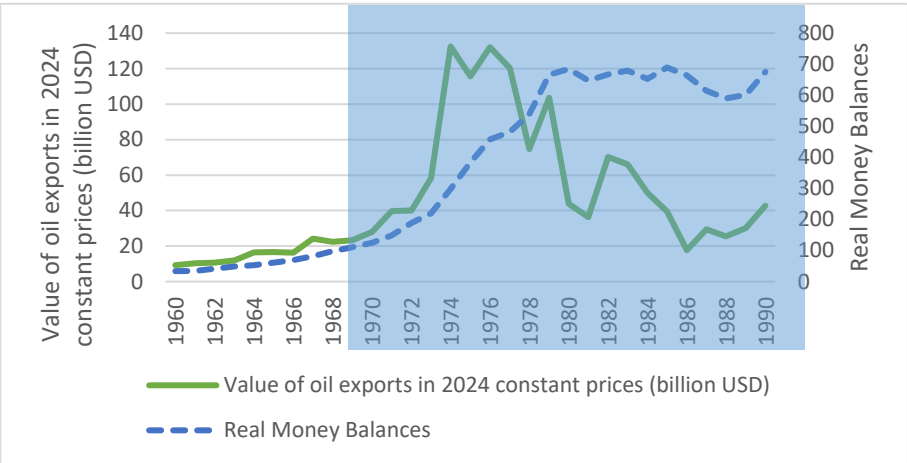

Figure 5. Real Value of Oil Exports and Real Broad Money Balances (M2) in Iran, 1960–1990. Real broad money is calculated using Central Bank data, and real oil export value is computed using U.S. CPI from the World Bank and oil export data from the Central Bank and OPEC.

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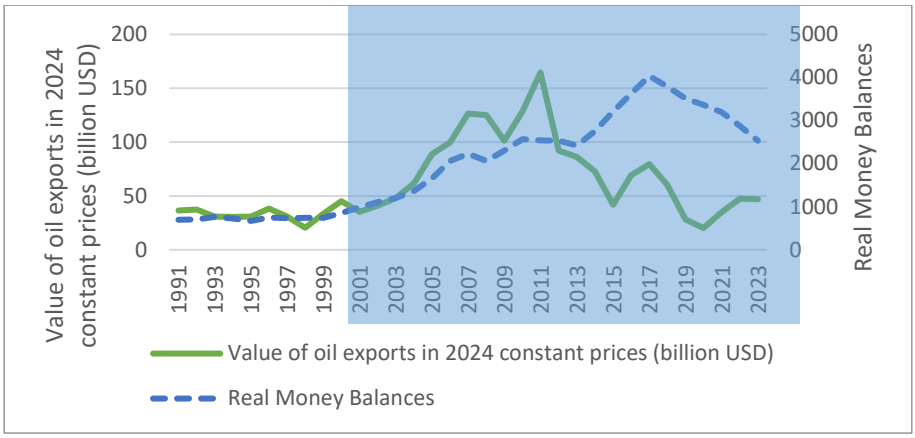

Figure 6. Real Value of Oil Exports and Real Broad Money (M2) Balances in Iran, 1991–2023. Real Money Balances is calculated using Central Bank data, and real oil export value is computed using U.S. CPI from the World Bank and oil export data from the Central Bank and OPEC.

During 2014–2017, high real deposit interest rates deferred consumption, preventing money supply growth from translating into aggregate demand growth, resulting in significantly lower price growth relative to money supply growth. Following the exchange rate surge, renewed sanctions, inflationary expectations, and reduced real deposit interest rates in 2018, higher price level growth led to a declining trend in real money balances.

Darabi (2024) reformulated the monetary model incorporating oil-related natural resource rents (World Bank, 2010). Oil rents have a pronounced effect on exchange rates due to: (1) their highly uneven distribution across countries and (2) the wide volatility in real oil prices. As shown in Figure 11, the reformulated monetary model substantially addresses the explanatory shortfall of the standard monetary model's exchange rate trends. The disconnection between the monetary model exchange rate and the unofficial exchange rate in 2014–2017 is attributable to high real deposit interest rates. This pattern is also evident in other oil-exporting countries (Figure 12). The key implication of their study for this research is the confirmation of natural resource rents as a dominant factor in explaining the disconnection between money supply, the general price level, and the exchange rate. Their study demonstrates that natural resource rents are the primary driver of why money supply growth

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does not fully translate into inflationary effects in Iran and other oil-exporting countries.

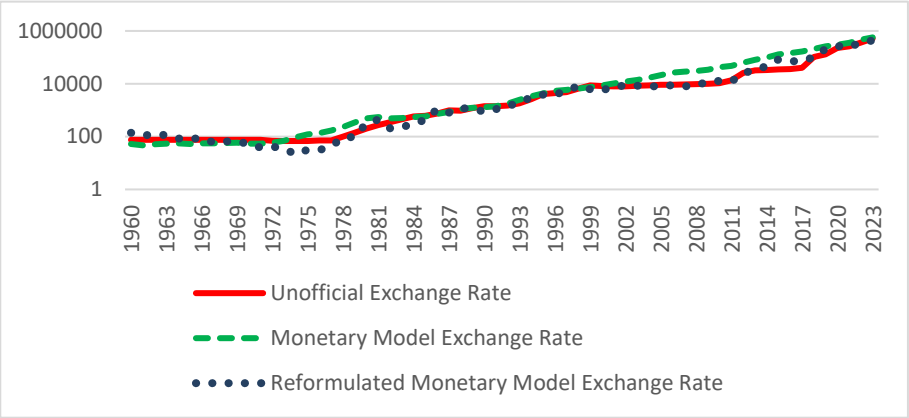

Figure 7. Unofficial Exchange Rate, Monetary Model Exchange Rate, and Reformulated Monetary Model Exchange Rate in Iran, 1960–2023. The figure is sourced from Darabi (2024) (doctoral dissertation).

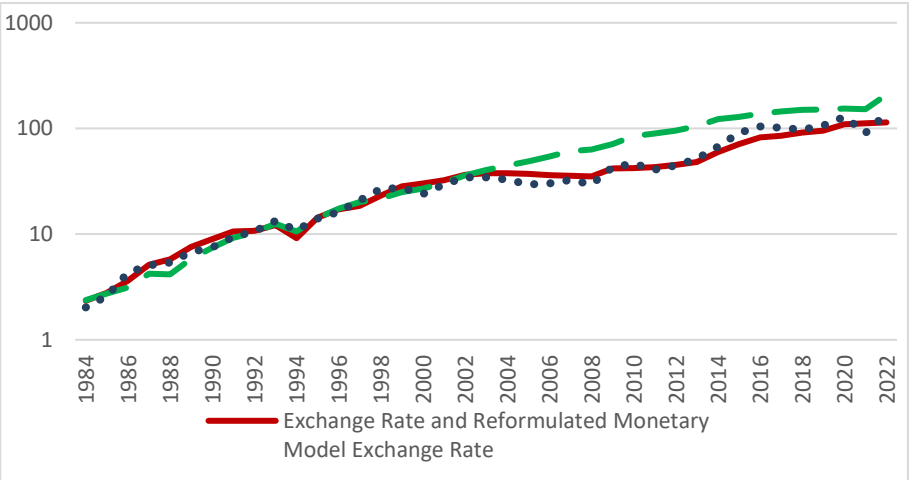

Figure 8. Average of Exchange Rate and Reformulated Monetary Model Exchange Rate in 26 Oil-Exporting Countries, 1984–2022. The figure is sourced from Darabi (2024) (doctoral dissertation).

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4 Empirical Findings

This section conducts an empirical test of the study's hypotheses. The primary hypothesis posits that changes in the level of oil-related natural resource rents are the reason for the rejection of the monetary theory and the lack of proportional growth in the general price level and exchange rate compared to money growth relative to real output. This hypothesis has three key implications for the exchange rate, inflation, and real money balances: (1) the gap between the actual exchange rate (ex_t) and the monetary model exchange rate (exm_t) is driven by natural resource rents ($roil_t$); (2) the gap between the price index (cpi_t) and the money supply-to-real output ratio ($m_t - y_t$), which should not exist under the quantity theory, is driven by natural resource rents; and (3) real money balances have a long-term relationship with natural resource rents. To test these hypotheses, the following relationships are employed. Given the significance of the real interest rate discussed in the previous section, it is included as an explanatory variable. Except for the real interest rate, all other variables are in logarithmic form.

$$exm_t - ex_t = \alpha_1 + \alpha_2 roil_t + \alpha_3 rr_t + u_t \quad (6)$$

$$(m_t - y_t) - cpi_t = \beta_1 + \beta_2 roil_t + \beta_3 i_t + \epsilon_t \quad (7)$$

Here, i_t and rr_t denote the nominal and real interest rate on bank deposits, calculated as the difference between the nominal one-year term deposit rate and annual inflation. For the years 2016 to 2022, where reported deposit rates significantly deviate from reality, the interbank rate plus 2% is used. The real value of oil exports serves as a proxy for natural resource rents, justified by the alignment between the terms-of-trade trend and the real value of oil exports (Figure 8). It is expected that the long-run coefficients for the real value of oil exports are positive and statistically significant in all relationships. A significant long-run coefficient for the real value of oil exports in Equation (6) indicates that the gap between the monetary model exchange rate and the realized exchange rate is driven by oil rents, confirming the study's hypothesis, as evident in Figure 11. A significant coefficient in Equation (7) has two implications: first, it suggests that the gap between excess money supply growth over output growth and the general price level (violating the quantity theory) is rooted in oil rents, consistent with the real exchange rate's dependence on the real value of oil exports (Figures 7 and 8); second, it indicates that real money balances, beyond output, are influenced by natural resource rents, as observed in Figures 9 and 10.

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To examine long-run relationships, the Bounds Test based on the Autoregressive Distributed Lag (ARDL) model, developed by Pesaran et al. (2001), is employed. The sample covers the period from 1960–2023. In this approach, the dependent variable must be I(1), while other variables can be I(0) or I(1), a condition satisfied for Equations (6) and (7). The variable dd is used as a dummy variable for the sanction years 2012 and 2018 in the estimation. As shown in Table 1, unit root and cointegration tests confirm that the necessary conditions for the ARDL model, including the dependent variable being I(1), are satisfied.

Table 1
Stationary Test with intercept and trend and intercept

	H0: I (0)	**H0: I (1)**
	Panel A: Intercept	
$(m_t - y_t) - cpi_t$	-2.26 (0.19)	-4.05 (0.00)
$exm_t - ex_t$	-2.09 (0.25)	-6.05 (0.00)
$roil_t$	-2.55 (0.11)	-8.53 (0.00)
rr_t	-3.84 (0.00)	-7.51 (0.00)
i_t	-5.49 (0.00)	-9.33 (0.00)
	Panel B: Trend and intercept	
$(m_t - y_t) - cpi_t$	-1.63 (0.77)	-4.67 (0.00)
$exm_t - ex_t$	-1.77 (0.71)	-6.16 (0.00)
$roil_t$	-2.48 (0.34)	-8.50 (0.00)
rr_t	-4.03 (0.01)	-7.45 (0.00)
i_t	-6.81 (0.00)	-9.27 (0.00)

Note. Numbers are t values and the numbers within prentices are p-values. Source: Research findings

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Table 2
Estimated Coefficients for Equations (6) and (7)

	Eq (6): SBC ARDL (3,3,0)	**Eq (7): SBC ARDL (1,0,0)**
Estimated long-run coefficients		
roil	0.98***	1.09***
rr	_	0.03*
i	0.03**	_
Panel B: Error correction representation for the selected ARDL		
$\Delta[(m_t - y_t) - cpi_t]$	0.67***	_
$\Delta[(m_{t-1} - y_{t-1}) - cpi_{t-1}]$	-0.37***	_
$\Delta roil_t$	-0.04*	_
$\Delta roil_{t-1}$	0.002	_
$\Delta roil_{t-2}$	-0.01***	_
i_t	0.002***	
$\Delta[exm_t - ex_t]$	0.67***	_
dd		-0.46***
ECT(-1)	-0.08***	-0.12***
F test (Bound test)		
F	9.80***	6.62***
Diagnostic tests		
Serial correlation $\chi^2(2)[p - value]$	0.96 [0.62]	0.06 [0.99]
Normality $Jarque - Bera[probability]$	0.26 [0.88]	0.94 [0.62]
Heteroskedasticity $\chi^2(1)[p - value]$	0.62 [0.43]	1.12 [0.29]

Note. *, *, and *** denote significance at the 10%, 5%, and 1% levels, respectively. Source: Research findings

As the estimation results indicate, the long-run coefficients and the F-statistic are statistically significant, supporting the study's hypotheses. Specifically, oil rents have contributed to both an increased divergence between the monetary model exchange rate and the realized exchange rate and an increased divergence between money supply growth relative to output (implied inflation in monetary theory) and realized inflation. Thus, the study's hypotheses are not rejected based on the evidence. It is worth noting that this study does not aim to identify the determinants of inflation or exchange rate growth but asserts that the deviation of the exchange rate from its fundamental value in the monetary model is directly related to the level of natural resource rents, a claim supported by the results. Similarly, it asserts that the deviation of inflation from its fundamental value in the monetary model is directly related to the level of natural resource rents, which is also corroborated by the results.

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5 Conclusion and Policy Implications

Despite Iran's economy experiencing high, predominantly double-digit inflation for over five decades, inflation has occasionally subsided and, notably, has been lower than what long-run monetary theory predicts. This study posits that natural resource rents, particularly from oil and gas, which are not part of domestic production factors' value added but enable the appropriation of foreign value added, have mitigated: (1) part of the aggregate demand-supply gap (excess demand) resulting from government expenditure directives and money supply growth, thereby reducing inflationary pressures; and (2) the gap between domestic monetary asset supply and demand (excess domestic money supply), alleviating pressures on domestic currency depreciation. Consequently, during periods of abundant oil rents, both inflationary pressures from money supply growth and pressures on domestic currency depreciation should have been reduced.

In addition to providing a theoretical framework, this study demonstrates why the gap between money supply growth and inflation has varied over time due to the abundance of natural resource rents. It also explains why the gap between the monetary model exchange rate and the realized exchange rate, and even the simple PPP exchange rate, has been influenced by the abundance of natural resource rents over time. Specifically, the results indicate that in the 1970s and 2000s (1970s and 2000s), when inflation was significantly lower than money supply growth and the exchange rate was substantially below what the monetary model predicts, the abundance of natural resource rents provides the explanation. As shown in prior studies, incorporating natural resource rents into a reformulated monetary model of exchange rate determination yields a more robust explanation of exchange rate behavior.

Moreover, this study estimates two equations to test its hypotheses. The first equation regresses the deviation between the monetary model exchange rate and the realized exchange rate on the real value of oil exports (as a proxy for oil rents), with results indicating that increased oil rents widen this deviation, supporting the study's hypothesis. The second equation regresses the deviation between implied inflation in monetary theory (money supply growth minus real output growth) and realized inflation on the real value of oil exports, with results showing that increased oil rents also widen this deviation, further supporting the hypothesis.

Thus, the study's findings suggest that oil rents have played a significant role in reducing both the excess demand gap in the commodity market, thereby alleviating inflationary pressures, and the excess domestic money supply gap, mitigating exchange rate pressures.

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6 Policy Recommendations

The policy implications of this study include the need to consider the role of oil rents in money demand analyses. Additionally, the findings suggest that effective foreign exchange market management and the prevention of exchange rate volatility—prerequisites for macroeconomic stability—require fiscal policy to refrain from issuing expenditure directives that drive money growth and rely on natural resource rents to temporarily mitigate their inflationary and exchange rate effects. This is critical for both long-term macroeconomic stability and improving resource allocation and long-term economic growth.

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