Economics from the Top Down

new ideas in economics and the social sciences

Do High Interest Rates Reduce Inflation? A Test of Monetary Faith

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February 4, 2023

> *They did not mind stating apparently opposed truths;*
> *they knew that they could give to men a higher truth,*
> *in which the contradictories became two sides of the same truth.*
>
> — Rev. Stopford A. Brooke, 1872

Whenever inflation rears its head, the call soon comes to raise interest rates. The rationale is simple. Higher interest rates put a damper on the supply of money. And this monetary clamp slows inflation.

It's so intuitive that it must be true.

Or is it?

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As the Reverend Brooke observes, it takes a person of true conviction to ignore apparent contradictions. As such, this post is designed to test your monetary faith.

According to monetary orthodoxy, higher interest rates reduce inflation. Yet the evidence demonstrates that the opposite is true: higher interest rates are associated with *higher* inflation.

With this evidence in mind, I invite you to read on. Put your monetary faith to the fire and see if it can survive.

In the quantity of money we believe

Economics has many high priests. But when it comes to the supply of money, there is but one true prophet. His name is Milton Friedman. Beginning in the 1940s, Friedman made waves by proclaiming that many of society's problems boiled down to the mismanagement of the money supply.

True, some of Friedman's colleagues balked at this bold reduction. Economist Robert Solow, for example, could barely contain his indignation. "Everything reminds Milton of the money supply," he complained. "Well, everything reminds me of sex, but I keep it out of the paper."

Critics aside, there is one area where Friedman's ideas reign virtually unchallenged: *inflation*. According to Friedman, inflation is caused by an oversupply of money. His theory (or rather, the theory he popularized) starts with an accounting definition that relates the quantity of money, M, to the average price level, P:

$$MV = PT$$

So far, we're dealing with a truism. By definition, the left side of our formula is equivalent to the right side. However, things get more interesting when we introduce cause and effect. According to Friedman, causation goes from left to right. Too much money, M, induces a rise in prices, P. Inflation!

$$M \longrightarrow P$$

Now, you'll notice that I've dropped the terms V and T. (We'll come back to them in a moment, as they will test our monetary faith.) For now, just marvel at the simplicity of our theory. To control inflation, all we must do is regulate the money supply.

That's where *interest rates* come in.

Interest rates, economists observe, affect people's willingness to borrow money. Why? Because when interest rates rise, the cost of servicing debt increases. And in the face of this rising cost, a rational person will borrow less money. Continuing the story, it turns out that borrowing is the main way that new money is created. Putting it all together, higher interest rates ought to slow the creation of money, and thus reduce inflation. *QED*.

Doubts among the priesthood

Unfortunately, while Friedman's theory of monetary regulation is widely accepted, some economists still profess doubts. For example, in 2004, Federal Reserve chair Ben Bernanke admitted that monetary policy is less than an exact science. According to Bernanke, controlling the money supply is like driving a dilapidated car. If you happen to arrive at your destination, it's mostly by luck:

> [I]f making monetary policy is like driving a car, then the car is one that has an unreliable speedometer, a foggy windshield, and a tendency to respond unpredictably and with a delay to the accelerator or the brake.
>
> (Ben Bernanke, 2004)

Diving a bit deeper, it seems that Bernanke had good reason to question his faith. To see why, let's return to our canonical equation:

$$MV = PT$$

Continuing Bernanke's vehicle analogy, imagine that the economy is our car and interest rates are the brake. When we hike the rate of interest, we press the brake on the money supply (M). If all goes well, prices (P) will stop growing. Inflation solved!

Or not.

As Bernanke alludes, inflation reduction is not guaranteed. For example, when we hit the monetary brakes, we may find that instead of manipulating prices (P), we kill the growth of T. That's not good. You see, T is the 'real' value of all monetary transactions — basically an expansive version of 'real' GDP. When we kill T, we shut off the economic growth engine. Doing so tends to make monetary managers unpopular.

There is also the problem of V — the 'velocity' of money. (In simple terms, this is the rate that money changes hands.) When we manipulate the money supply, we assume a direct brake line to prices. But it's possible that movement in V will put slack in our brake cable, sending us screaming through a red light.

And if that's not enough, there is the more dire problem of the supply of money itself. We *assume* that raising interest rates will slow the growth of the money supply. But as you will see, when we hold our faith to the empirical fire, it bursts into flames.

This is the problem at hand. There is no evidence that monetary orthodoxy is correct. And yet when faced with this contradiction, our faith must endure.

Some basic science

If our empirical journey is to be a true trial of faith, it must inflict sufficient pain. To that end, it's worth reviewing some basic science.

Here's the problem. If you are trained in economics, the evidence that I'm about to show you may not evoke doubt. Indeed, some members of the economics profession will stare at this data and conclude that it *confirms* their monetary faith.[1] Of course, faith retention is our ultimate goal. But we want the path to be difficult, otherwise the trial is a sham.

(Any fool can have faith when ignorant. Only the wise can maintain belief in the face of overwhelming contradiction.)

To ensure that the empirical evidence induces sufficient doubt, I will start my foray into monetary policy with some basic science of regulation. We begin in the abstract. Suppose that substance A regulates substance B. This regulation can have two directions. If an increase in A leads to a *reduction* in B, we say that A 'down-regulates' B. Alternatively, if an increase in A prompts a *rise* in B, we say that A 'up-regulates' B.

Returning to economics, faith dictates that interest rates down-regulate inflation. But before we get to the monetary data, let's set the stage. Let's observe what *actual* down-regulation looks like. And let's contrast this evidence with the pattern of up-regulation.

[1] The astrophysicist Stacy McGaugh observes that this empirical reversal is a common method 'explaining' evidence that contradicts your theory. To escape from an empirical cul-de-sac, simply reverse the obvious conclusion:

> [T]here is no result so obvious that someone won't claim the exact opposite. Indeed, the more obvious the result, the louder the claim to contradict it.

Given that the data contridicts monetary canon, brazen reversal of the obvious should be part of every economists' faith-keeping playbook.

Down-regulation: Insulin and blood sugar

Over millions of years, animals have evolved sophisticated ways of keeping their body chemistry in a stable state — what scientists call 'homeostasis'. While the process is complex, the individual ingredients are fairly simple.

The working of insulin is a good example. Insulin is a hormone that down-regulates blood sugar (glucose). It's effect is easy to observe. When we inject insulin into the body, blood sugar levels drop.

Figure 1 shows an example. Here, a scientist has injected a rabbit with insulin. After the injection, the rabbit's serum insulin levels spike and fall (blue curve). In response, the rabbit's glucose levels drop and then rise (red curve). It's a negative correlation, indicative of down-regulation.

Up-regulation: CO2 and the Earth's temperature

Turning to up-regulation, the relation between carbon dioxide and climate change is top of mind. According to NASA scientist James Hansen, CO2 is the "principal determinant of Earth's climate state, the radiative 'control knob' that sets global mean temperature". In other words, CO2 up-regulates the Earth's temperature.

On this fact, the evidence is compelling. Figure 2 shows the long-term relation between carbon dioxide concentrate (in the atmosphere) and the Earth's average temperature. Unsurprisingly, the coupling is tight. When CO2 concentration increases, so does temperature.

Looking at the paleo-climate data, it's worth commenting on how climate skepticism has played out. For the most part, skeptics do not dispute the coupling between CO2 and temperature. (The evidence is simply too strong.) Instead, they imagine a Rube-Goldberg-type mechanism that drives the climate, while somehow pulling CO2 along for the ride. By imagining this mechanism, skeptics rescue their faith that the current bout of climate change is 'natural' … i.e. not human-induced.

Here, then, is the road ahead. Notice that not even the boldest climate skeptic looks at the evidence in Figure 2 and concludes that CO2 *down-regulates* the Earth's temperature. But for the economic faithful, that is the task at hand. Monetary orthodoxy dictates that interest rates down-regulate inflation. Yet when we look at the data, we see nothing but up-regulation.

Can our faith survive this clash?

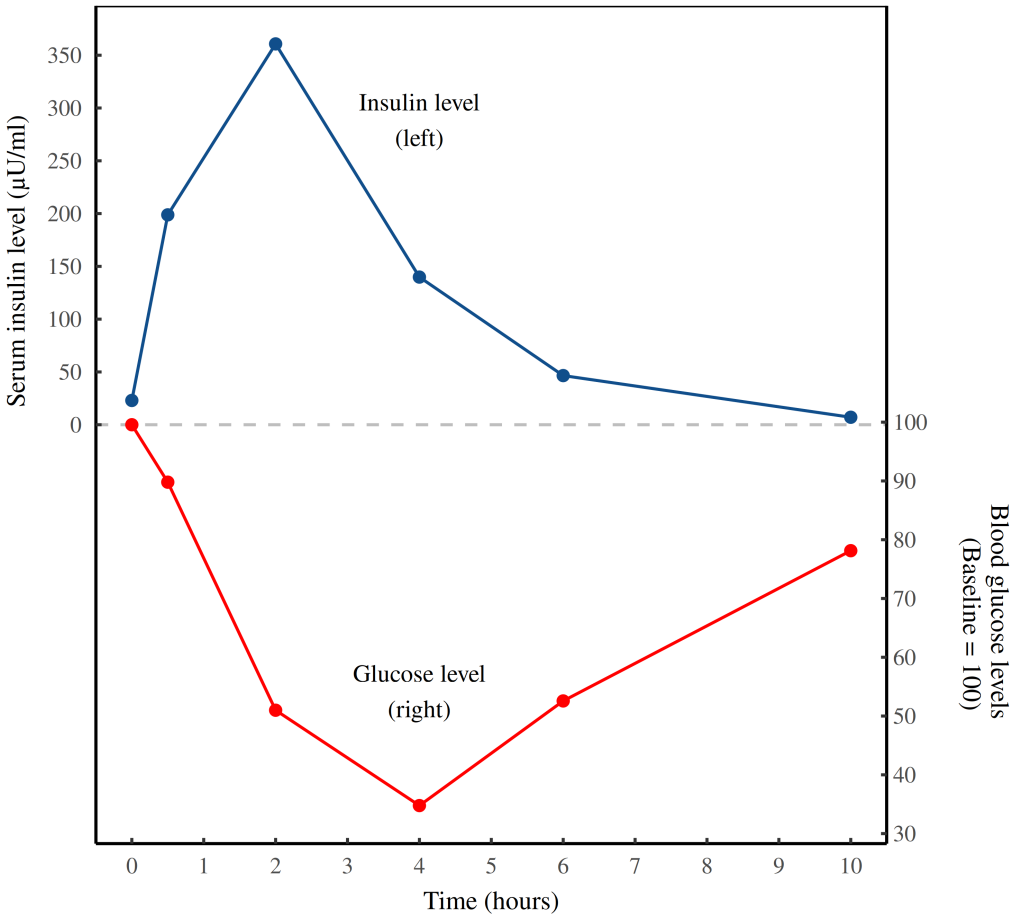

Figure 1: Insulin down-regulates blood sugar

This figure shows what happens when a rabbit is injected with insulin. After the injection (at time zero), the rabbit's serum insulin levels rise and fall (blue). In response, the rabbit's blood glucose levels fall and then rise (red). It is a simple example of down-regulation. Data is from Kang and Singh (2005).

A trial of faith

Now that we've reviewed the science of regulation, let's outline your task. Your goal is to stare at the on-coming evidence while keeping faith that higher interest rates reduce inflation.

Your trial will have two main components:

Trial 1: (Not) maintaining the money supply. I will show you evidence that higher interest rates are associated with a *faster* expansion of the money supply. In the face of this evidence, you must keep faith that higher interest rates *slow* the growth of the money supply.

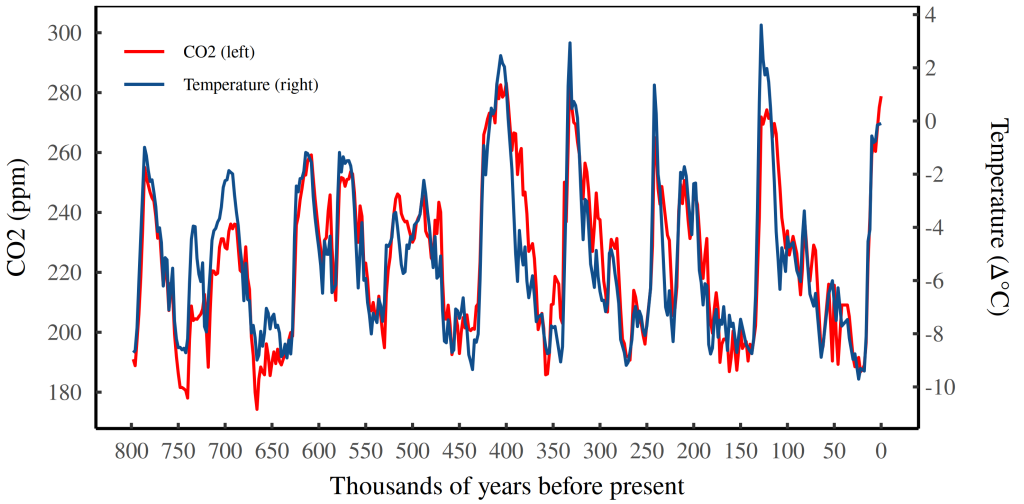

Figure 2: Carbon dioxide up-regulates the Earth's temperature

This figure shows estimates for the long-term coupling between atmospheric CO2 concentration and the Earth's average temperature. (Temperature is measured in terms of the deviation from the average over the last 1000 years.) Both estimates come from Antarctic ice cores. CO2 data is from Lüthi et al (2008) and can be downloaded here. Temperature data is from Jouzel et al (2007), and can be downloaded here. Note that I've averaged both series over 2000-year intervals.

Trial 2: (Not) reducing inflation. I will show you evidence that higher interest rates are associated with *higher* inflation. Your goal is to keep faith that the opposite is true — raising interest rates 'reduces' inflation.

Before we proceed, let's pause to discuss methods. All of my data comes from the World Bank database (which is free to access). The data covers most of the world's countries, observed over the years 1960 to 2021. (Note that the exact coverage varies by country).

And with that, let's jump into our dilapidated monetary car and have faith that we'll arrive at our destination with life and limbs intact.

Trial 1: Interest rates and the supply of money

According to orthodoxy, inflation is a problem of 'too much money chasing too few goods'. As such, the best way to manage inflation is to regulate the supply of money using the knob of interest rates.

The reasoning is straightforward.

If I have a fixed budget for interest payments, it follows that when interest rates climb, I can carry less debt. And since less debt means less money gets created, *ceteris paribus* (other things being equal), raising interest rates should either: (a) lower the supply of money; or (b) slow its growth.

That's the theory. In the real world, it seems that both outcomes fail to materialize. Instead, higher interest rates are associated with *faster* monetary expansion. Figure 3 runs the numbers.

Here, I've taken all the countries in the World Bank database and plotted their lending interest rates (horizontal axis) against the annual growth of their local money supply (vertical axis). To show the trend, I've put the raw data into bins. Each blue point represents the midpoint of an interest-rate bin. Within each bin, I then measure the median growth rate of the money supply (blue line). The shaded region shows the middle 50% of money-supply growth rates.

Looking Figure 3, you might think that there's a mistake. It seems that interest rates go as high as 200%. Surely that's an error?

Actually, no.

The World Bank database is quite clear that triple-digit interest rates exist. For example, in 1992, Nicaragua had interest rates north of 450%. And in 1994, Ukraine experienced interest rates of about 250%. A year later, Angola had interest rates above 200%. (I could go on.) Of course, we can quibble with the measurements behind these numbers. (Sampling error is always possible). But what seems clear is that interest rates can get absurdly high.

Now according to orthodoxy, these extreme interest rates should be money-supply killers. But if that were true, the trend in Figure 3 would slope downward (meaning higher interest rates slow the growth of the money supply.) However, the trend slopes *upward*. In other words, higher interest rates are associated with a *faster* expansion of the money supply.

Something is not right.

But before we lose our faith in monetary theory, we should make sure that the evidence is sound. To that end, let's turn to Figure 4. Here, I've take the interest-rate and money-supply data and measured the trend *within* countries. To do that, I take each country with relevant data and then calculate the correlation between the lending interest rate and the growth rate of the local money supply. The histogram shows the distribution of correlations across all countries.

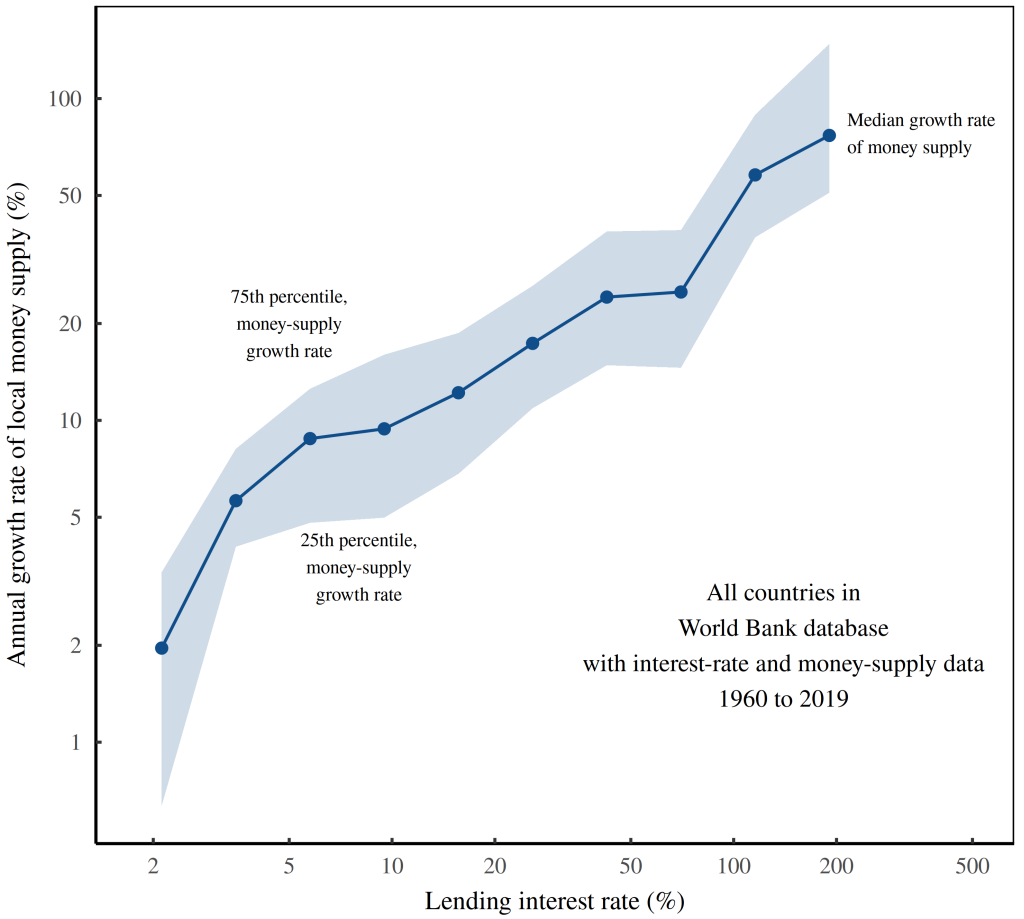

Figure 3: Interest rates and the growth of the money supply — the pattern across countries

Looking at international data, this figure compares national lending interest rates with the annual growth of the local money supply within each country. To measure the average trend, I put interest rates into size bins. Each blue point indicates the midpoint of a bin. Within each interest-rate bin, I then measure the range of monetary growth. The blue line indicates the median growth rate within each bin. The shaded region shows the middle 50% of the growth-rate data (the 25th to 75th to percentiles). Note that both axes use a logarithmic scale. Sources and methods

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Monetary orthodoxy predicts that the correlation should be negative, meaning higher interest rates slow the growth of the money supply. On that front, we do find some countries with a negative correlation (red bars). But they are in the minority. For the vast majority of countries (about 77%, as shown by the blue bars), the correlation is positive. In other words, the norm is that higher interest rates are associated with a *faster* expansion of the money supply.

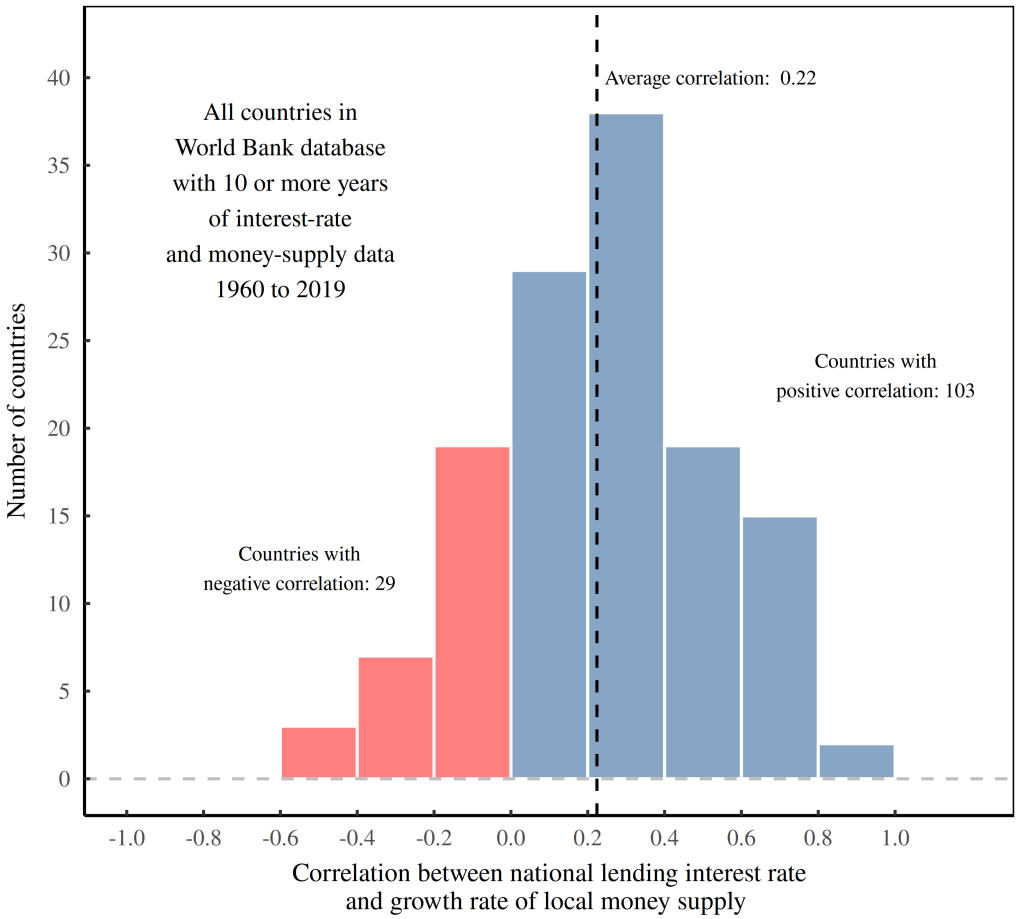

Figure 4: Interest rates and the growth of the money supply — the correlation within countries

This figure analyzes the within-country connection between lending interest rates and the local growth of the money supply. The analysis works as follows. For every country with ten or more years of money-interest data in the World Bank database, I calculate the correlation between the money-supply growth rate and the interest rate. The histogram then shows the distribution of correlations. In this sample, 29 countries have a negative correlation (red). The other 103 countries have a positive correlation (blue). So it seems that within most countries, higher interest rates lead to a faster growth of the money supply. Sources and methods

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A heretical explanation

Looking at Figures 3 and 4, the evidence soundly contradicts monetary orthodoxy. Higher interest rates are associated with a *faster* expansion of the money supply.

Now, in the face of this evidence, *your* goal is to keep the monetary faith. But *my* goal is to hold your faith to the fire. With that in mind, let's fan the flames by turning to the writings of an economic heretic.

In his article 'Do Interest Rate Hikes Worsen Inflation?' Tim Di Muzio claims that there is good reason for monetary orthodoxy to be wrong. The problem boils down to the *ceteris paribus* clause — the assumption that when we raise interest rates, nothing else changes. To restate orthodox reasoning, if I have a fixed budget to spend on servicing my debt, then it follows that when interest rates rise, I'll borrow less money. But what if my debt-servicing budget is *not* fixed? Then orthodoxy breaks down.

In the real world, Di Muzio observes, businesses don't need to reduce borrowing in the face of higher interest rates. Why? Because when interest expenses increase, businesses can respond by trying to *raise their income*. In other words, businesses can maintain their debt levels by passing their greater debt-servicing costs along to customers.

Let's lay out the consequences of this heretical thinking. If businesses practice 'cost-plus' pricing — meaning they tack a fixed markup onto their current costs — then raising interest rates ought to *stimulate* inflation.

What's frightening is that this simple reasoning is consistent with the monetary evidence in Figures 3 and 4. And it is also consistent with the evidence to come. Hold on to your faith. The ride is about to get bumpy.

Trial 2: Interest rates and inflation

According to economic canon, inflation regulation has two parts. First, we raise interest rates, which slows the growth of the money supply. Second, the induced scarcity of money slows inflation.

Ultimately, it is the inflation reduction that is sacred. Regardless of whether the money supply responds the way it should (it doesn't), when interest rates rise, inflation must decrease. *It is known*.

And yet the evidence tests our faith.

Let's look at it now. Figure 5 plots the international trend between lending interest rates (within countries) and annual inflation rates. According to orthodoxy, we ought to see a downward-sloping line (meaning higher interest rates reduce inflation). But we see the opposite. As interest rates grow, it seem that inflation responds by ... *increasing*.

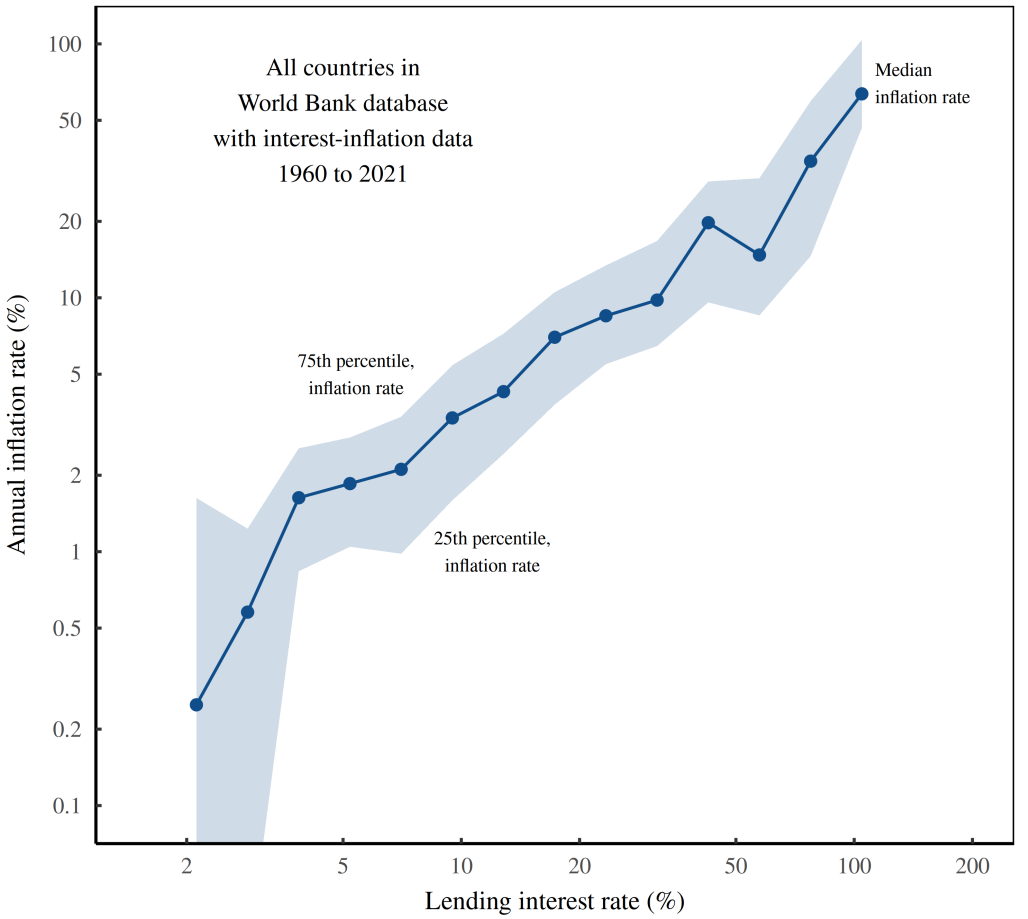

Figure 5: Interest rates and the annual rate of inflation — the pattern across countries

This figure analyzes the international relation between the inflation rate (within countries) and the lending rate of interest. To show the average trend, I put inflation rates into bins, plotted on the horizontal axis. The blue point indicates the midpoint of the bin. On the vertical axis, I then plot the range of inflation rates (within each bin). The blue line shows the median inflation rate. The shaded region indicates the middle 50% of the inflation data. Note that both axes use a logarithmic scale. Sources and methods

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While this international evidence is troubling, let's not lose faith. If we look at the pattern *within* countries, perhaps we can rescue monetary orthodoxy. To that end, let's study Figure 6.

Here, I've taken each country in the World Bank database (with the relevant data) and measured the correlation between the annual inflation rate and the lending rate of interest. The histogram shows the distribution of within-country correlations. Again, the gods toy with our faith. In a few dozen countries (red), the interest-rate-inflation correlation is negative, as expected.

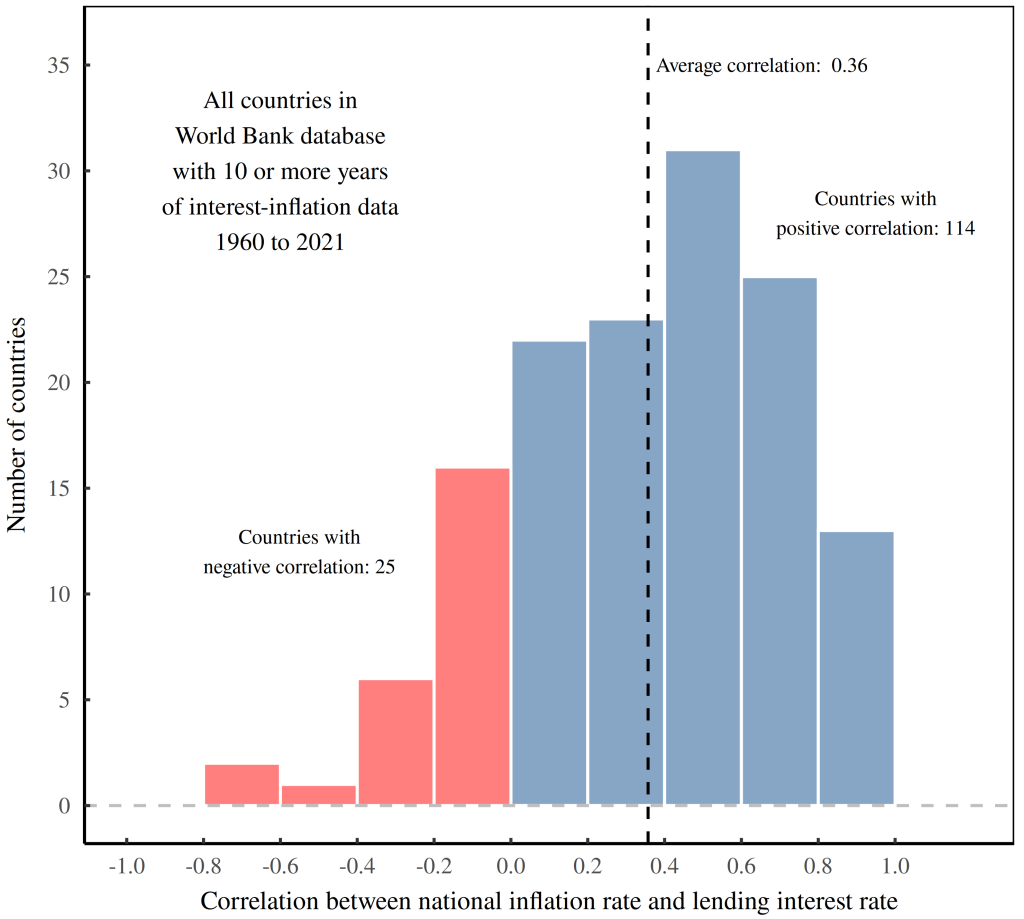

Figure 6: Interest rates and the annual rate of inflation — the correlation within countries

The figure analyzes the within-country correlation between lending interest rates and the annual rate of inflation. The steps are as follows. I start by selecting all countries in the World Bank database with ten or more years of interest-rate-inflation data. Within each country, I then measure the correlation between the rate of interest and the annual rate of inflation. The histogram then plots the distribution of within-country correlations. Red bars indicate a negative correlation. Blue bars indicate a positive correlation. Sources and methods

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But for the vast majority of countries — about 82% — the interest-rate-inflation correlation is positive. In other words, when interest rates get hiked, the norm is for inflation to *increase*.

Rescued by dynamics?

At this point, we may need a *deus ex machina* to rescue monetary orthodoxy. But before that, let's try one more trick for torturing the data. Perhaps dynamics can rescue us.

So far, I've compared interest rates to the rate of inflation. The results were difficult to swallow. But maybe if we look at *rates of change*, better evidence will show its face.

With annual change in mind, let's look at Figure 7. Here, I've plotted the international pattern between the annual change in lending interest rates and the annual change in inflation. According to monetary orthodoxy, we should see a downward trend. In other words, interest-rate hikes should prompt a decline in inflation. But instead, we see the opposite. When interest rates rise, so does inflation.

Admittedly, the dynamics data has failed to confess. But before we search for explanations, let's look at the pattern *within* countries. Figure 8 shows the data.

Here, I've analyzed the within-country correlation between the annual change in interest rates and the annual change in inflation. The histogram shows the distribution of within-country correlations. According to orthodoxy, the correlations should be mostly negative (indicated by red bars). However, we find the opposite. In about 68% of countries (shown in blue), changes in interest rates correlate *positively* with changes in the inflation.

A post mortem

At this point, your faith in monetary orthodoxy should be shaken. According to canon, higher interest rates slow the growth of the money supply, and thus reduce inflation. And yet, when we look at the evidence, there is no sign of this pattern. Instead, higher interest rates are associated with both a *faster* expansion of the money supply, and *higher* rates of inflation.

Now, in the face of this falsifying evidence, there is a way to resurrect our monetary faith. But before we get to it, let's turn up the pain dial one more notch.

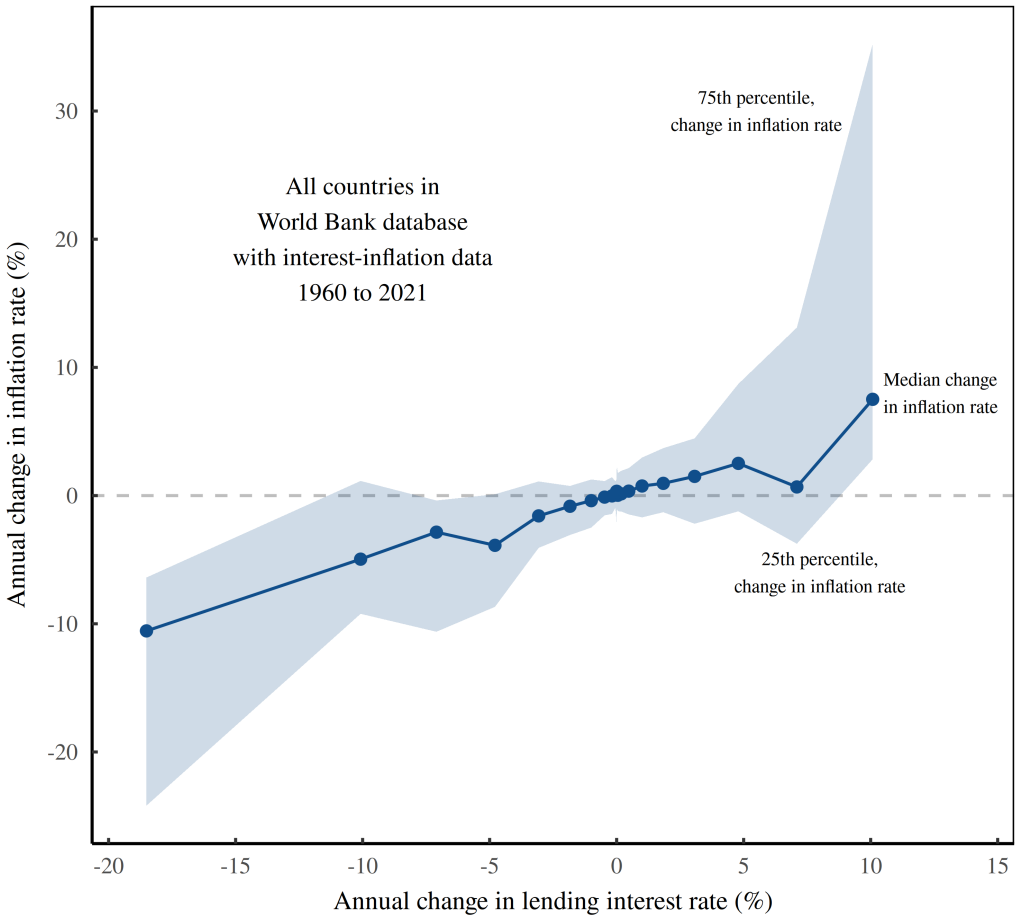

Figure 7: The annual change in interest rates vs. the annual change in inflation — the pattern across countries

This figure analyzes the international relation between the annual change in lending interest rates and the annual change in inflation. To illustrate the trend, I place interest-rate changes into bins, plotted on the horizontal axis. The blue points indicate the midpoint of the bin. (Note that the size of the bins increases with the absolute value of interest-rate change. The goal here is to account for the spread in the data. Most interest-rate changes are small, but a few are quite large.) Within each bin, I then measure the range of inflation-rate change. The blue line shows the median change. The shaded region indicates the middle 50% of the data. Sources and methods

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How should we interpret the fact that higher interest rates are associated with higher inflation? The least painful option is to suppose that monetary policy is well-intentioned yet toothless. In other words, policy-makers consistently respond to higher inflation with higher interest rates. And yet equally consistently, these rate hikes fail to do their job.

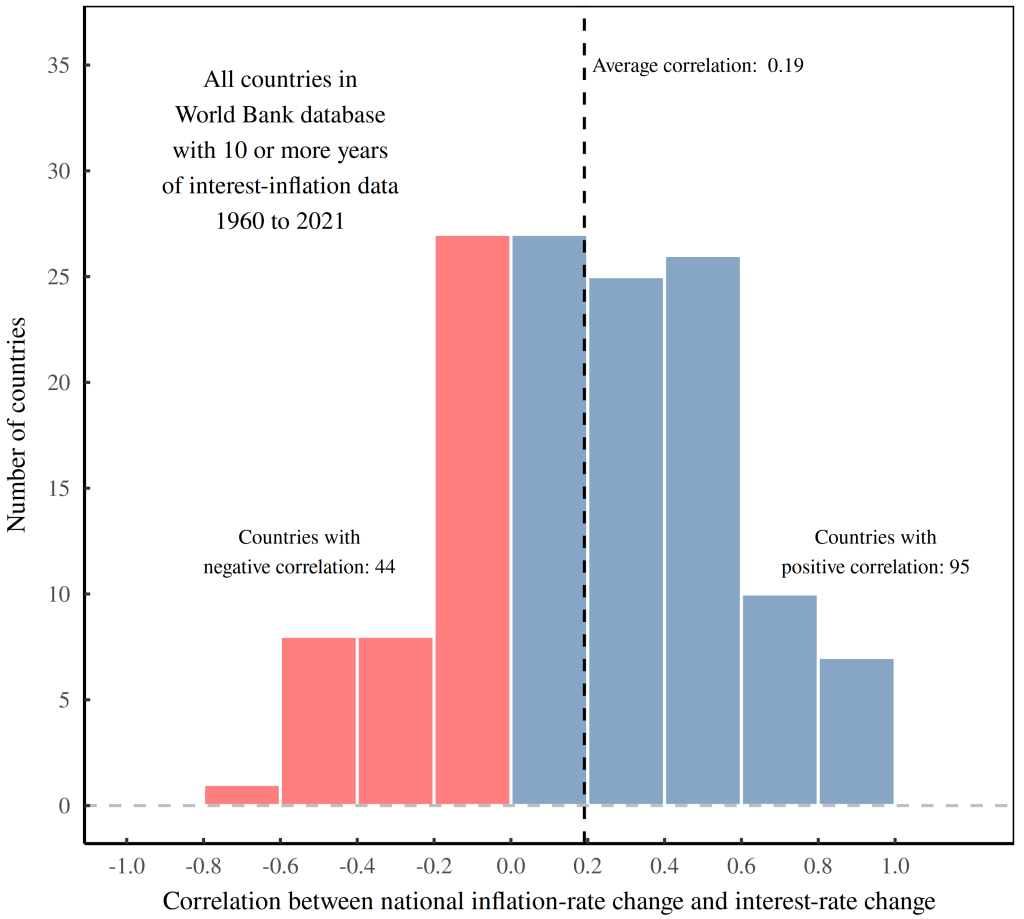

Figure 8: The annual change in interest rates vs. the annual change in inflation — the correlation within countries

This figure analyzes the within-country connection between interest rate changes and changes in inflation. I start with all countries in the World Bank database with ten or more years of interest rate and inflation data. Within each country, I then measure the correlation between the annual change in the lending interest rate, and the annual change in inflation. The histogram then shows the distribution of correlations. Countries with a negative correlation are shown in red. Those with a positive correlation are shown in blue. Sources and methods

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A more incendiary possibility is that monetary orthodoxy does the opposite of what it intends. As heretic Tim Di Muzio observes, if businesses practice cost-plus pricing (tacking a fixed markup onto existing costs), then higher interest rates should actually *stoke* inflation. Blasphemy, yes. But the idea is supported by the evidence.

In distortions we trust

At this point, our monetary faith is inches from the fire, about to be engulfed by flames. Can we rescue it? That depends on our willingness to engage in magical thinking.

I, for one, have adopted the following solution. Monetary orthodoxy is *true by definition*. Interest rates everywhere and always down-regulate inflation. It's just that in our imperfect world, there are ubiquitous distortions that hide this truth.

Think of it this way. When we step into our monetary-policy car, we are climbing into a vehicle that appears dilapidated. Worse, the car usually takes us to the wrong destination. But in the face of this failure, we have faith. In some invisible higher plane, our car is *pristine*.

In other words, by definition, monetary policy works the way it should. It's just that we can never observe this canonical outcome, for it is hidden by a barrage of distortions. And yet we have faith. We have faith that the plane of economic truth is there, waiting to be imagined.

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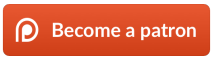

Sources and methods

All monetary data is from the World Bank as follows:

- inflation rates: series FP.CPI.TOTL.ZG — inflation consumer prices (annual %)
- interest rates: series FR.INR.LEND — lending interest rate (%)
- money supply: series FM.LBL.BMNY.CN — broad money (current local currency unit)

Further reading

Di Muzio, T. (2022). Do interest rate hikes worsen inflation? *Strange Matters*. https://strangematters.coop/interest-rate-hikes-worsen-inflation-volcker-shock/

Hansen, J., Sato, M., Hearty, P., Ruedy, R., Kelley, M., Masson-Delmotte, V., et al.others. (2016). Ice melt, sea level rise and superstorms: Evidence from paleoclimate data, climate modeling, and modern observations that 2 c global warming could be dangerous. *Atmospheric Chemistry and Physics*, *16*(6), 3761–3812. https://acp.copernicus.org/articles/16/3761/2016/