Replicating *Intermediary asset pricing: New evidence from many asset classes*

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For our project, we were tasked with replicating 4 tables from the paper Intermediary asset pricing: New evidence from many asset classes. This paper aims to show how shocks to the equity capital ratio of financial intermediaries, specifically Primary Dealer counterparties of the New York Federal Reserve, exhibit substantial explanatory power for cross-sectional variance in expected returns across diverse asset classes, indicating the pivotal role of intermediary capital risk factor in understanding asset pricing dynamics. We split our work up amongst our selves to accomplish this task. Jacob and Young Jin worked on Tables 1, 2, and A,1. Monica and Jaehwa worked on Table 03. We found some success in replicating some of the more recent numbers but found much difficulty in determining the exact methodology used by the original authors to determine which holding company to use. We had two different attempts at this, the first was to choose the holding company that held the primary dealer for the longest period of time in a specified period - this data is in ticks.csv. The second method was to use the current holding company for a given primary dealer - this data is in ticksv2.csv. The third, which we did not have time to do, would be to have sub-periods for each holding company of a given primary dealer, which would likely produce the most accurate results. To pull our data, we used the Compustat database through our WRDS subscription. Specifically, we used the quarterly fundamentals table from Compustat.

Creation of Table 01 writeup:

The author sourced the historical list of primary dealers from the NY Fed's website, matching these dealers with data on their publicly-traded holding companies from CRSP/Compustat for U.S. dealers or Datastream for foreign dealers. Table 1 presents primary dealer designations as of February 11, 2014.

To replicate Table 1, we developed a code to automatically download the list of NY Fed primary dealers from the NYFed website, with an option to cache the list in an Excel file for future use. This cached list then serves as the starting point for the replication process.

The replication begins with data from the Excel file, utilizing two worksheets: one listing the primary dealers as of February 2014 and another documenting all primary dealers from 1960 to 2014, including their start and end dates. We aligned the 2014 primary dealer list with their start dates, carefully addressing discrepancies between the two Excel sheets, such as extra spaces or punctuation differences. For dealers that paused their operations and later resumed, we considered their most recent start date. The process includes adjustments for these variances to ensure alignment with the original table. Start dates are organized from the earliest to the most recent. The author manually matched dealers to their publicly-traded holding companies. For the replication, a 'ticks.csv' file was generated and stored in the 'data/manual' directory, containing the mapping between primary dealers and their holding companies. This mapping was then used to add an additional column to the 'mergeddf' table, showing the holding company for each dealer. Prior to transitioning to the LaTeX format, we conducted unit testing to verify the accuracy of 'Primary Dealer' names and 'Start Dates' in Table01.mergeddffinal. This involved removing spaces and periods and applying specific naming exceptions to ensure the data matched expected results. Exceptions included renaming 'Bank of Nova Scotia, New York Agency' to 'Bank of Nova Scotia, NY Agency' and abbreviating 'Merrill Lynch, Pierce, Fenner and Smith Incorporated' to 'Merrill Lynch, Pierce, Fenner and Smith'. Finally, we converted the table into LaTeX format using the tolatex() function, saving it in the output directory. This .tex file was then used to create the complete table in LaTeX format for inclusion in the report, replicating the entire table accurately.

Replicating Table 1 was a straightforward task, with the main challenge being to resolve name discrepancies across two worksheets. These discrepancies arose from differences in spacing, punctuation, periods, abbreviations, and variations between lowercase and uppercase in the data sourced from the NY Fed website. After addressing these factors, Table 1 successfully matched with the original data.

1 Replication - Table 1

Primary dealers as of February 11, 2014.

Primary dealers, as designated by the NY Fed serve as its trading counterparties as it implements monetary policy. Primary dealers are obliged to: (i) participate consistently in open market operations to carry out US monetary policy; and (ii) provide the NY Fed's trading desk with market information and analysis. Primary dealers are also required to participate in all US government debt auctions and to make reasonable markets for the NY Fed. From 1960 to 2014, a total of 168 dealers were designated as primary ones, some of whom lost this designation previously. See http://www.newyorkfed.org/markets/primarydealers.html for current and historical lists of primary dealers.

Primary Dealer	Holding Company	Start Date
GOLDMAN, SACHS & CO.	The Goldman Sachs Group, Inc.	1974-12-04 00:00:00
BARCLAYS CAPITAL INC.	Barclays PLC	1998-04-01 00:00:00
HSBC SECURITIES (USA) INC.	HSBC Holdings PLC	1999-06-01 00:00:00
BNP PARIBAS SECURITIES CORP.	BNP Paribas Group	2000-09-15 00:00:00
DEUTSCHE BANK SECURITIES INC.	Deutsche Bank AG	2002-03-30 00:00:00
MIZUHO SECURITIES USA INC.	Mizuho Financial Group, Inc.	2002-04-01 00:00:00
CITIGROUP GLOBAL MARKETS INC.	Citigroup Inc.	2003-04-07 00:00:00
UBS SECURITIES LLC.	UBS Group AG	2003-06-09 00:00:00
CREDIT SUISSE SECURITIES (USA) LLC	Credit Suisse Group AG	2006-01-16 00:00:00
CANTOR FITZGERALD & CO.	Cantor Fitzgerald & Company	2006-08-01 00:00:00
RBS SECURITIES INC.	The Royal Bank of Scotland Group PLC	2009-04-01 00:00:00
NOMURA SECURITIES INTERNATIONAL, INC.	Nomura Holdings, Inc.	2009-07-27 00:00:00
DAIWA CAPITAL MARKETS AMERICA INC.	Daiwa Securities Group Inc. (Japan)	2010-04-01 00:00:00
J.P. MORGAN SECURITIES LLC	JPMorgan Chase & Co.	2010-09-01 00:00:00
MERRILL LYNCH, PIERCE, FENNER & SMITH INCORPORATED	Bank of America Corporation	2010-11-01 00:00:00
RBC CAPITAL MARKETS, LLC	ROYAL BANK OF CANADA	2010-11-01 00:00:00
SG AMERICAS SECURITIES, LLC	Soci t G n rale S.A.	2011-02-02 00:00:00
MORGAN STANLEY & CO. LLC	Morgan Stanley Group Inc.	2011-05-31 00:00:00
BMO CAPITAL MARKETS CORP.	Bank of Montreal	2011-10-04 00:00:00
BANK OF NOVA SCOTIA, NEW YORK AGENCY	The Bank of Nova Scotia (Scotiabank)	2011-10-04 00:00:00
JEFFERIES LLC	Jefferies LLC	2013-03-01 00:00:00
TD SECURITIES (USA) LLC	The Toronto-Dominion Bank	2014-02-11 00:00:00

Creation of Table A.1 writeup:

For Table A.1, the author gathered a complete historical list of primary dealers with their start and end dates from 1960 to 2014 from the NY Fed's website and presented it in full within Table A.1.

To replicate this table, we initially loaded the NY Fed primary dealer list from a cached file, focusing solely on the 'Dealer Alpha' worksheet. This worksheet provided details on all primary dealers within the specified timeframe, including their start and end dates. When converting this data to LaTeX format using the tolatex() function, we had to carefully manage unescaped symbols in company names. We also split the primary dealer list at the midpoint, inserting a separator column to mirror the layout seen in Table A.1. The resulting .tex file was saved in the output directory and utilized to accurately recreate the complete table in LaTeX for the report.

However, replicating Table A.1 faced certain limitations not encountered with Table 1. Although our replication closely matched the original Table A.1 in terms of format, primary dealer listings, and the accuracy of start and end dates, achieving an exact match was complicated by several factors: The original paper used shorter, abbreviated company names in a less consistent manner compared to Table 1, unlike the NY Fed's Excel file which provided full names. The author consolidated the list by combining entries that, despite name changes, continued as primary dealers. In contrast, the NY Fed's Excel file offered a more extensive list by capturing all dealers, inclusive of their names pre- and post-change, leading to a greater total number of entries. The use of abbreviations and the author's approach to consolidating listings posed challenges for conducting precise unit testing. The subjective nature of abbreviating primary dealer names and merging entries hindered a straightforward comparison.

2 Replication - Table A.1

Primary dealers, 1960–2014.

The New York Federal Reserve Bank's list of primary dealers. We have condensed the list slightly by combining entries that differ due to name changes but maintain continuity in primary dealer role, most commonly due to the dealer acquiring another firm. However, we continue to list acquisition targets or merged entities separately for the period that they appear on the dealer list prior to acquisition.

Primary Dealer	Start Date	End Date	Primary Dealer	Start Date	End Date
ABN AMRO BANK, N.V., NY BR	2002-12-09 00:00:00	9/15/2006	HARRIS TRUST	1965-07-15 00:00:00	8/31/1988
ABN AMRO INCORPORATED	1998-09-29 00:00:00	12/8/2002	HARRIS-NESBITT THOMSON SEC., INC.	1992-12-31 00:00:00	9/7/1993
AUBREY G. LANSTON & CO., INC.	1960-05-19 00:00:00	4/17/2000	HSBC SECURITIES (USA) INC.	1999-06-01 00:00:00	Current
BA SECURITIES, INC.	1994-04-18 00:00:00	9/30/1997	HSBC SECURITIES, INC.	1994-05-09 00:00:00	5/31/1999
BANC OF AMERICA SECURITIES LLC	1999-05-17 00:00:00	11/1/2010	HUTTON	1977-11-02 00:00:00	12/31/1987
BANC ONE CAPITAL MARKETS, INC	1999-04-01 00:00:00	8/1/2004	IRVING SECURITIES, INC.	1960-05-19 00:00:00	7/31/1989
BANCAMERICA ROBERTSON STEPHEN	1997-10-01 00:00:00	8/31/1998	J.P. MORGAN SECURITIES INC.	2001-05-01 00:00:00	9/1/2010
BANCAMERICA SECURITIES, INC.	1998-09-01 00:00:00	9/30/1998	J.P. MORGAN SECURITIES LLC	2010-09-01 00:00:00	Current
BANK OF AMERICA NT & SA	1971-11-17 00:00:00	4/15/1994	J.P.MORGAN SECURITIES,INC.	1960-05-19 00:00:00	4/30/2001
BANK OF NOVA SCOTIA, NEW YORK AGENCY	2011-10-04 00:00:00	Current	JEFFERIES & COMPANY, INC.	2009-06-18 00:00:00	3/1/2013
BANKERS TRUST	1960-05-19 00:00:00	7/7/1989	JEFFERIES LLC	2013-03-01 00:00:00	Current
BARCLAYS CAPITAL INC.	1998-04-01 00:00:00	Current	KIDDER, PEABODY & CO., INCORPORATED	1979-02-07 00:00:00	12/30/1994
BARCLAYS DE ZOETE WEDD GSI	1989-12-07 00:00:00	3/1/1990	KLEINWORT BENSON GOV'T SEC., INC.	1980-02-13 00:00:00	12/27/1989
BARCLAYS DE ZOETE WEDD SECURITIES IN	1990-03-02 00:00:00	6/30/1996	L.F.ROTHSCHILD & CO., INC.	1987-05-18 00:00:00	1/17/1989
BARTOW LEEDS & CO.	1960-05-19 00:00:00	6/14/1962	L.F.ROTHSCHILD,UNTERBERG,TOWBIN	1986-12-11 00:00:00	5/15/1987
BEAR,STEARNS & CO., INC.	1981-06-10 00:00:00	10/1/2008	LEHMAN	1976-11-25 00:00:00	12/31/1987
BECKER	1971-11-17 00:00:00	9/10/1984	LEHMAN BROTHERS INC.	1995-08-31 00:00:00	9/22/2008
BLYTH & CO., INC.	1962-04-16 00:00:00	1/14/1970	LEHMAN GOV'T SEC. INC.	1973-02-22 00:00:00	1/29/1974
BLYTH EASTMAN DILLON CAPITAL MARKETS	1974-12-05 00:00:00	12/31/1979	LEHMAN GOVERNMENT SECURITIES INC	1990-08-01 00:00:00	8/30/1995
BMO CAPITAL MARKETS CORP.	2011-10-04 00:00:00	Current	LLOYDS GOV'T SECURITIES, INC.	1987-12-22 00:00:00	4/28/1989
BMO NESBITT BURNS CORP.	2000-02-15 00:00:00	3/31/2002	MALON S. ANDRUS INC.	1960-05-19 00:00:00	11/24/1965
BNP PARIBAS SECURITIES CORP.	2000-09-15 00:00:00	Current	MANUFACTURERS HANOVER	1983-08-31 00:00:00	7/29/1988
BNY SECURITIES, INC.	1989-08-01 00:00:00	8/9/1990	MANUFACTURERS HANOVER SECURITIES COR	1988-08-01 00:00:00	12/31/1991
BROPHY,GESTAL, KNIGHT AND CO., L.P.	1987-05-08 00:00:00	6/19/1988	MERRILL LYNCH GOVERNMENT SEC. INC.	1960-05-19 00:00:00	2/11/2009
BT ALEX. BROWN INCORPORATED	1997-10-23 00:00:00	6/4/1999	MERRILL LYNCH, PIERCE, FENNER & SMITH INCORPORATED	2010-11-01 00:00:00	Current
BT SECURITIES CORPORATION	1989-07-10 00:00:00	10/22/1997	MF GLOBAL	2011-02-02 00:00:00	10/31/2011
BZW SECURITIES INC.	1996-07-01 00:00:00	3/31/1998	MIDLAND-MONTAGU GOV. SEC.,INC.	1975-08-13 00:00:00	7/26/1990
C.F. CHILDS & CO., INC	1960-05-19 00:00:00	6/29/1965	MIZUHO SECURITIES USA INC.	2002-04-01 00:00:00	Current
CANTOR FITZGERALD & CO.	2006-08-01 00:00:00	Current	MORGAN STANLEY & CO. INCORPORATED	1978-02-01 00:00:00	5/31/2011
CARROLL MCENTEE & MCGINLEY INC.	1976-09-29 00:00:00	5/6/1994	MORGAN STANLEY & CO. LLC	2011-05-31 00:00:00	Current
CHASE MANHATTAN CAPITAL MARKETS CORP	1987-07-01 00:00:00	12/19/1988	N.Y.HANSEATIC CORP.	1984-02-08 00:00:00	7/26/1984
CHASE MANHATTAN GOV'T SECURITIES	1970-07-15 00:00:00	6/30/1987	NATIONSBANC CAPITAL MARKETS, INC.	1993-10-01 00:00:00	9/30/1997
CHASE SECURITIES, INC	1996-04-01 00:00:00	4/30/2001	NATIONSBANC MONTGOMERY SECURITIES, INC	1997-10-01 00:00:00	9/30/1998
CHASE SECURITIES, INC	1988-12-20 00:00:00	3/31/1996	NATIONSBANC MONTGOMERY SECURITIES, LLC	1998-10-01 00:00:00	5/16/1999
CHEMICAL	1960-05-19 00:00:00	3/31/1989	NATIONSBANK OF NORTH CAROLINA, N.A.	1993-07-06 00:00:00	9/30/1993
CHEMICAL SECURITIES INC	1992-01-01 00:00:00	3/31/1996	NESBITT BURNS SECURITIES INC.	1995-06-01 00:00:00	2/14/2000
CHEMICAL SECURITIES, INC.	1989-04-01 00:00:00	12/31/1991	NOMURA SECURITIES INTERNATIONAL,INC	1986-12-11 00:00:00	11/30/2007
CIBC OPPENHEIMER CORP.	1997-12-04 00:00:00	5/2/1999	NOMURA SECURITIES INTERNATIONAL,INC	2009-07-27 00:00:00	Current
CIBC WOOD GUNDY SECURITIES CO	1996-03-27 00:00:00	12/3/1997	NORTHERN TRUST	1973-08-08 00:00:00	5/29/1986
CIBC WORLD MARKETS CORP.	1999-05-03 00:00:00	2/8/2007	NUVEEN GOV'T SEC. INC.	1971-11-18 00:00:00	8/27/1980
CITIBANK	1961-06-15 00:00:00	4/13/1989	PAINE WEBBER INCORPORATED	1976-11-25 00:00:00	12/4/2000
CITICORP SECURITIES MARKETS, INC.	1989-04-14 00:00:00	7/14/1993	PAINE, WEBBER, JACKSON & CURTIS INC.	1972-06-22 00:00:00	6/27/1973
CITICORP SECURITIES, INC.	1993-07-15 00:00:00	11/30/1998	PARIBAS CORPORATION	1997-05-01 00:00:00	9/14/2000
CITIGROUP GLOBAL MARKETS INC.	2003-04-07 00:00:00	Current	PRUDENTIAL SECURITIES INCORPO	1991-02-25 00:00:00	12/1/2000
CONTINENTAL BANK, NATIONAL ASSOC.	1988-12-15 00:00:00	8/30/1991	PRUDENTIAL-BACHE	1975-10-29 00:00:00	2/24/1991
CONTINENTAL ILL.	1960-05-19 00:00:00	12/14/1988	RBC CAPITAL MARKETS CORPORATION	2009-07-08 00:00:00	11/1/2010
COUNTRYWIDE SECURITES CORPORATION	2004-01-15 00:00:00	7/15/2008	RBC CAPITAL MARKETS, LLC	2010-11-01 00:00:00	Current
COUNTY NATWEST GOV. SEC., INC.	1988-09-29 00:00:00	1/13/1989	RBS SECURITIES INC.	2009-04-01 00:00:00	Current
CREDIT SUISSE 1ST BOSTON LLC	2003-01-17 00:00:00	1/16/2006	REFCO PARTNERS	1980-11-19 00:00:00	5/7/1987
CREDIT SUISSE FIRST BOSTON CO	1996-12-16 00:00:00	1/16/2003	S.G. WARBURG & CO., INC.	1988-06-24 00:00:00	7/26/1995
CREDIT SUISSE SECURITIES (USA) LLC	2006-01-16 00:00:00	Current	SALOMON BROTHERS INC.	1960-05-19 00:00:00	8/31/1998
CRT GOVERNMENT SECURITIES,INC.	1987-12-22 00:00:00	7/5/1993	SALOMON SMITH BARNEY INC.	1998-09-01 00:00:00	4/6/2003
CS FIRST BOSTON CORPORATION	1993-10-12 00:00:00	12/15/1996	SANWA SECURITIES (USA) CO., L	1994-01-01 00:00:00	7/20/1998
D.W. RICH & CO., INC	1960-05-19 00:00:00	12/31/1969	SANWA-BGK SECURITIES CO., L.P.	1988-06-20 00:00:00	12/31/1993
DAIWA CAPITAL MARKETS AMERICA INC.	2010-04-01 00:00:00	Current	SBC CAPITAL MARKETS INC.	1995-01-03 00:00:00	6/2/1996
DAIWA SECURITIES AMERICA INC.	1986-12-11 00:00:00	4/1/2010	SBC GOVERNMENT SECURITIES, INC.	1990-03-29 00:00:00	1/2/1995
DEAN WITTER REYNOLDS INC.	1977-11-02 00:00:00	4/30/1998	SBC WARBURG DILLON READ INC.	1997-09-03 00:00:00	6/28/1998
DEUTSCH BANC ALEX. BROWN INC.	2001-01-12 00:00:00	3/29/2002	SBC WARBURG INC.	1996-06-03 00:00:00	9/2/1997
DEUTSCHE BANK GSI	1990-12-13 00:00:00	9/30/1993	SECOND DISTRICT SECURITIES CO., INC	1961-06-15 00:00:00	8/27/1980
DEUTSCHE BANK SECURITIES CORPORATION	1993-10-01 00:00:00	10/31/1995	SECURITIES GROUPS	1960-05-19 00:00:00	6/5/1983
DEUTSCHE BANK SECURITIES INC.	1998-06-01 00:00:00	1/11/2001	SECURITY PACIFIC NATIONAL BANK	1986-12-11 00:00:00	1/17/1991
DEUTSCHE BANK SECURITIES INC.	2002-03-30 00:00:00	Current	SG AMERICAS SECURITIES, LLC	2011-02-02 00:00:00	Current
DEUTSCHE MORGAN GRENFELL/C.J.	1995-11-01 00:00:00	5/29/1998	SG COWEN SECURITIES CORP.	1999-07-01 00:00:00	10/31/2001
DILLON, READ & CO., INC.	1988-06-24 00:00:00	9/2/1997	SHEARSON LEHMAN	1988-01-01 00:00:00	7/31/1990
DISCOUNT CORPORATION OF NEW YORK	1960-05-19 00:00:00	8/10/1993	SMITH BARNEY INC.	1994-06-01 00:00:00	8/31/1998
DLJ SECURITIES CORPORATION	1974-03-06 00:00:00	12/31/2000	SMITH BARNEY SHEARSON INC.	1993-08-02 00:00:00	5/31/1994
DRESDNER KLEINWORT BENSON NOR	1997-05-08 00:00:00	4/29/2001	SMITH BARNEY, HARRIS UPHAM & CO.,INC	1979-08-22 00:00:00	8/1/1993
DRESDNER KLEINWORT SECURITIES LLC	2006-09-18 00:00:00	6/26/2009	SOUTHERN CALIF S&L ASSOC	1983-06-07 00:00:00	8/5/1983
DRESDNER KLEINWORT WASSERSTEIN SECURITIES LLC	2001-04-30 00:00:00	9/18/2006	TD SECURITIES (USA) LLC	2014-02-11 00:00:00	Current
DREXEL BURNHAM LAMBERT	1960-05-19 00:00:00	3/28/1990	THE FIRST BOSTON CORPORATION	1960-05-19 00:00:00	10/11/1993
EASTBRIDGE CAPITAL INC.	1992-06-18 00:00:00	5/29/1998	THE NIKKO SECURITIES CO. INT'	1987-12-22 00:00:00	1/3/1999
F.I. DUPONT & CO	1968-12-12 00:00:00	7/18/1973	THOMSON MCKINNON SECURITIES INC.	1986-12-11 00:00:00	7/7/1989
FIRST CHICAGO	1960-05-19 00:00:00	1/1/1990	UBS SECURITIES INC.	1989-12-07 00:00:00	2/29/1996
FIRST CHICAGO CAPITAL MARKETS	1990-01-02 00:00:00	3/31/1999	UBS SECURITIES LLC	1996-03-01 00:00:00	6/28/1998
FIRST INTERSTATE	1964-07-31 00:00:00	10/31/1986	UBS SECURITIES LLC.	2003-06-09 00:00:00	Current
FIRST INTERSTATE CAPITAL MARKETS,INC	1986-11-03 00:00:00	6/17/1988	UBS WARBURG LLC.	2000-05-01 00:00:00	6/8/2003
FIRST N/B OF BOSTON	1983-03-21 00:00:00	11/17/1985	WARBURG DILLON READ LLC.	1998-06-29 00:00:00	4/28/2000
FIRST PENNCO SEC. INC.	1974-03-07 00:00:00	8/27/1980	WEEDEN & CO., INC.	1976-06-17 00:00:00	5/15/1978
FUJI SECURITIES INC.	1989-12-28 00:00:00	3/31/2002	WERTHEIM SCHRODER & CO., INC.	1988-06-24 00:00:00	11/8/1990
GOLDMAN, SACHS & CO.	1974-12-04 00:00:00	Current	WESTPAC POLLOCK GOV'T SECURITIES INC	1987-02-04 00:00:00	6/27/1990
GREENWICH CAPITAL MARKETS, INC.	1984-07-31 00:00:00	4/1/2009	WHITE, WELD & CO INC.	1976-02-26 00:00:00	4/18/1978
HARRIS GOVERNMENT SECURITIES	1988-09-01 00:00:00	12/30/1992	WM. E. POLLOCK GOV'T SECURITIES,INC	1960-05-19 00:00:00	2/3/1987
HARRIS NESBITT THOMSON SEC. INC.	1993-09-08 00:00:00	5/31/1995	YAMAICHI INT'L (AMERICA), INC.	1988-09-29 00:00:00	12/4/1997
			ZIONS FIRST NATIONAL BANK	1993-08-11 00:00:00	3/31/2002

Table 2 was the first table our group was tasked with replicating. This table involves getting numbers such as total assets or market equity from CRSP Compustat database for different groups of firms, with the limitation that the firms be US domestic and have data available in CRSP Compustat. These groups were comprised of the primary dealers of the New York Fed, which are detailed in table A.1, all broker dealers, all banks, and all firms in Compustat. There were three time ranges that we observed, 1960-2012, 1960-1990, and 1990-2012. Replicating table 2 turned out to be a lot more involved than initially expected, due largely to the condition that we use the data of holding companies of the primary dealers rather than of the actual primary dealer. This required us to manually go through each individual dealer in the list of 112, and look up information about their holding company during a specified time period where they were considered a primary dealer. This was not a simple task because there were many cases where holding companies shifted multiple time within the specified period - forcing us to try and guess how the original author of the paper made this decision.

After finishing the main lookup file, ticks.csv, which including all primary dealers listed in table A.1, their holding companies, their start and end dates, and their permcos and gvkeys (identifiers for CRSP and Compustat respectively) we then focused on pulling data from the WRDS database. After establishing a connection with WRDS we were able to query data from multiple sources. We made use of the CRSP Compustat historical link table to do most of this research, as well as some holding companies lookups on Google and chatGPT. We queried a full list of link table data from the WRDS website and downloaded it in Excel format to be able to filter and make notes. We also queried the link table from the WRDS historical table and used this table to help merge SIC codes with our completed ticks.csv dataset. For the financials dataset, we opted to query data by gvkey since the data for table 2 was specifically for company level financials which are found through Compustat.

After having the primary dealer data in the proper format of total assets, total book debt, book equity, and market equity, it was now time to create our subgroups and query data for them. The first one we worked on was the broker dealer dataset, which, as specified in the paper, included all primary dealers in our main dataset plus any firms with the SIC code 6211 or 6221. Using the historical linktable and our primary dealer linktable we created our subset and then used it to query financial data from Compustat. Now with our two different subsets of data, we merged them on the date key and then performed our ratio calculation. This calculation was the total value of primary dealers divided by the sum of the total value of primary dealers and the total value of non-primary dealer broker dealers. We then repeated this methodology for the banks comparison group which was generally comprised of firms with the SIC code 6020. We had to use backfill and forward fill on some of the data due to gaps. These gaps were most prevalent in Banks and the period of 1960 to 1990.

Table 1: Updated

Metric			Total assets			Book debt			Book equity			Market equity
Source	BD	Banks	Cmpust.	BD	Banks	Cmpust.	BD	Banks	Cmpust.	BD	Banks	Cmpust.
Period												
1960-2012	0.895	0.329	0.142	0.894	0.333	0.168	0.897	0.312	0.053	0.892	0.325	0.038
1960-1990	0.903	0.188	0.095	0.902	0.190	0.115	0.888	0.217	0.048	0.857	0.239	0.037
1990-2012	0.883	0.507	0.200	0.882	0.512	0.232	0.906	0.433	0.057	0.932	0.437	0.039

Table 2: Original

Metric			Total assets			Book debt			Book equity			Market equity
Source	BD	Banks	Cmpust.	BD	Banks	Cmpust.	BD	Banks	Cmpust.	BD	Banks	Cmpust.
Period												
1960-2024	0.912	0.381	0.166	0.911	0.385	0.193	0.911	0.360	0.061	0.903	0.368	0.038
1960-1990	0.903	0.188	0.095	0.902	0.190	0.115	0.888	0.217	0.048	0.857	0.239	0.037
1990-2024	0.915	0.545	0.223	0.914	0.549	0.258	0.928	0.480	0.072	0.937	0.479	0.039

In the graphs below, we can see each of the four ratios shown over the original timeframe of 1960 to 2012 and the updated timeframe of 1960 to 2024.

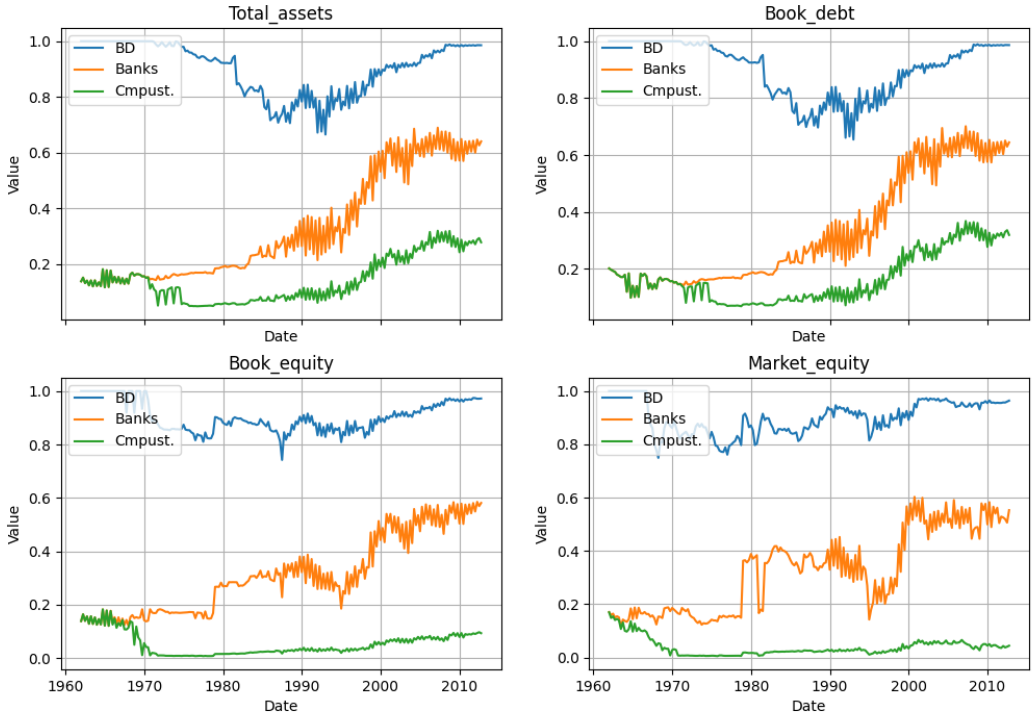


Table 3: Pairwise Correlations

Table 3 shows the pairwise correlations between various capital ratios and macroeconomic indicators over the sample period from Q1 1970 to Q4 2012, using the data from CRSP-Compustat, Datastream, and several macroeconomic databases.

The process of constructing Table 3 begins with the data from Table 2, 'prim_deal_merge_manual_data_w_linktable,' which assembles the comprehensive dataset for the primary dealers. This involves gathering the financial metrics—total assets, book equity, and market equity — to calculate the market and book capital ratios. The dataset starts a year before 1970 to set the stage for the subsequent factor calculation and growth rate analyses.

A key aspect of this paper is its engagement with the findings from Adrian-Etula-Muir (AEM), a paper highlighting the predictive power of broker-dealer leverage on stock market returns. Table 3 illustrates this engagement by including the AEM leverage factor as one of the major correlation variables. However, when we pulled the current FRED data, the numbers did not match those from the AEM paper. For instance, the total financial assets for the end of 2010.4Q, the AEM paper shows 2,075.1 billion dollars, whereas the current fred data shows 4,312.8 billion dollars. To account for the change in the metrics, we downloaded and used the dataset previously released for 1970-2012, which aligns with the AEM paper numbers.

After the data preparation, we calculated the capital ratios and transformed these ratios into analytical factors, employing AR(1) innovations. Market and book capital factors were defined as AR(1) innovations to the capital ratio, scaled by the lagged capital ratio. The AEM metrics were defined separately; the AEM implied capital as the inverse of broker–dealer book leverage from Flow of Funds used in AEM, and the AEM leverage factor (LevFac) as the seasonally adjusted growth rate in broker–dealer book leverage.

Next, we processed macroeconomic indicators such as earnings-to-price ratio (E/P), unemployment rate, financial conditions index, Real GDP and GDP growth, market excess returns, and market volatility. The E/P ratio is downloaded from a Shiller dataset, with the URL containing the most recently updated data. The market excess return is fetched from Fama-French research datasets, calculated as SPY returns minus the risk-free rate. Like the ratio and factor datasets, the macro dataset begins from a year before 1970 for the subsequent factor and growth rate computations.

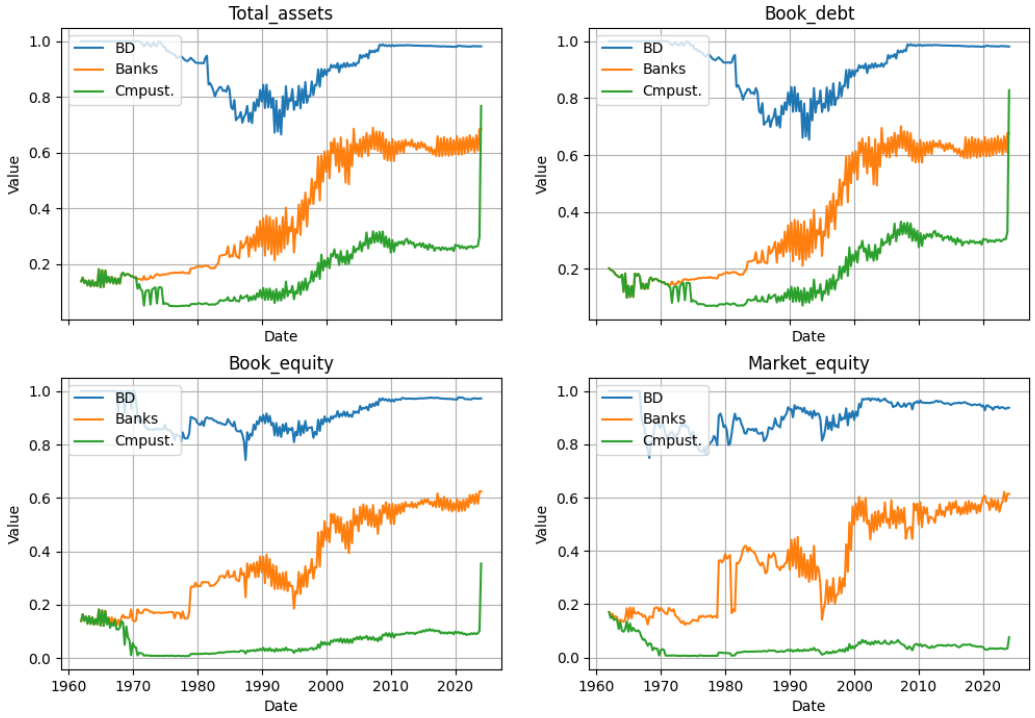


Table 3: The Chicago Fed National Financial Conditions Index (NFCI) starts from 1971. The others start from 1970.

	Market capital factor	Book capital factor	AEM leverage factor	E/P growth	Unemployment growth	Fina
count	172.00	172.00	172.00	172.00	172.00	
mean	-0.01	-0.00	0.01	-0.00	0.00	
std	0.26	0.11	0.19	0.07	0.05	
min	-0.62	-0.35	-0.45	-0.20	-0.09	
max	1.61	0.62	1.66	0.31	0.23	

Finally, we calibrated Panel A and B correlations to examine the relationships between the intermediary capital ratios and macroeconomic variables. Panel A focuses on the levels of financial ratios and macroeconomic variables, and Panel B focuses on the factors derived from the financial ratios and their growth rates. We summarize our findings into tables for Panel A and B, alongside a figure illustrating how the capital ratios have shifted over time. All time series are standardized to zero mean and unit variance for illustration. We get our final table, which is converted to LaTeX and outputted to a .tex file.

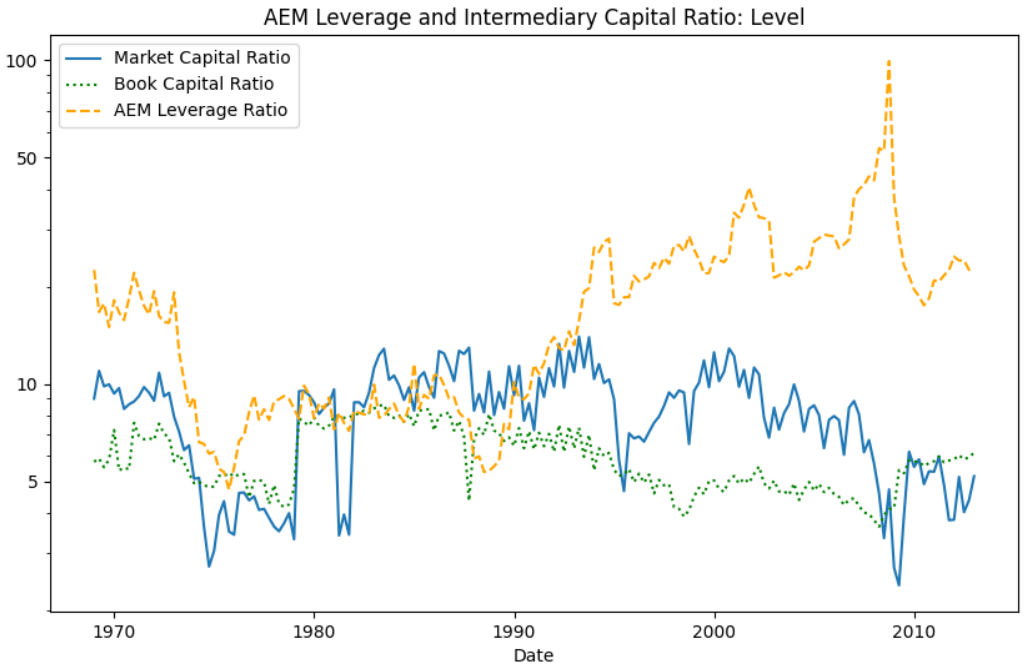
Table 4: Original

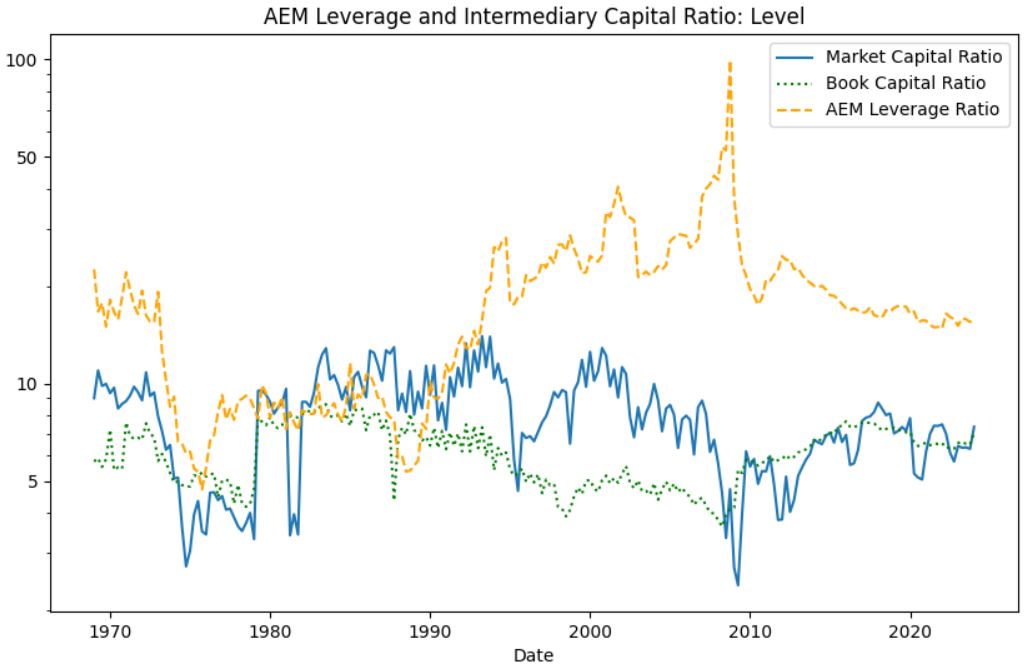
Panel A: Correlation of Levels			
	Market capital	Book capital	AEM leverage
Market capital	1.0	0.44	-0.1
Book capital		1.0	0.48
AEM leverage			1.0
E/P	-0.19	0.57	0.76
Unemployment	-0.19	0.47	0.31
GDP	-0.09	-0.49	-0.71
Financial conditions	-0.26	0.3	0.43
Market volatility	-0.04	0.06	0.11
Panel B: Correlation of Factors			
	Market capital	Book capital	AEM leverage
Market capital factor	1.0	0.44	-0.11
Book capital factor		1.0	0.1
AEM leverage factor			1.0
Market excess return	0.14	0.14	-0.02
E/P growth	-0.35	-0.01	0.28
Unemployment growth	-0.0	0.13	0.11
GDP growth	-0.04	-0.08	-0.11
Financial conditions growth	-0.13	0.02	0.09
Market volatility growth	-0.09	0.05	-0.11

Table 5: Updated

Panel A: Correlation of Levels			
	Market capital	Book capital	AEM leverage
Market capital	1.0	0.36	-0.05
Book capital		1.0	0.38
AEM leverage			1.0
E/P	-0.1	0.36	0.75
Unemployment	-0.13	0.24	0.3
GDP	-0.2	-0.09	-0.61
Financial conditions	-0.2	0.19	0.46
Market volatility	-0.06	0.08	0.08
Panel B: Correlation of Factors			
	Market capital	Book capital	AEM leverage
Market capital factor	1.0	0.44	-0.1
Book capital factor		1.0	0.11
AEM leverage factor			1.0
Market excess return	0.17	0.13	-0.01
E/P growth	-0.35	-0.02	0.25
Unemployment growth	-0.02	0.03	0.08
GDP growth	-0.0	-0.04	-0.08
Financial conditions growth	-0.1	0.03	0.08
Market volatility growth	-0.1	0.03	-0.1

In the graphs below, we can see the time series trend of the intermediary capital ratios and AEM leverage, over the original timeframe of 1960 to 2012 and the updated timeframe of 1960 to 2024. All time-series are standardized to zero mean and unit variance.


AEM Leverage and Intermediary Capital Ratio: Level
Market Capital Ratio
Book Capital Ratio
AEM Leverage Ratio
100
50
10
5
1970
1980
1990
2000
2010
Date


AEM Leverage and Intermediary Capital Ratio: Level
Market Capital Ratio
Book Capital Ratio
AEM Leverage Ratio
100
50
10
5
1970
1980
1990
2000
2010
2020
Date

This project of replication proved to be a fruitful endeavor. The most beneficial parts of this project were all of important computing concepts we used. We learned a lot about virtual environments, dependencies, command line, version control, and more. In addition, we were able to get some practice trying to replicating some somewhat complicated financial data, which will also be useful in our careers. Going forward we are going to have a better idea of how to approach a project for our employers because we understand how important and difficult automation can be and things such as dependency management - this will make us more aware of these problems as we encounter them in the workplace.