```
NaturalDisaster (
    DisasterID INT PRIMARY KEY,
    Name VARCHAR(255),
    Type VARCHAR(100),
    Date DATE
)

MacroeconomicImpact (
    DisasterID INT REFERENCES NaturalDisaster(DisasterID),
    LocationID INT REFERENCES Location(LocationID),
    GDP_Loss DECIMAL(10,2),
    GDP_Growth_Change DECIMAL(5,2),
    Inflation_Change DECIMAL(5,2),
    Unemployment_Change DECIMAL(5,2),
    PRIMARY KEY (DisasterID, Country)
)

MicroeconomicImpact (
    DisasterID INT REFERENCES NaturalDisaster(DisasterID),
    LocationID INT REFERENCES Location(LocationID),
    Agriculture_Growth DECIMAL(5,2),
    Industry_Growth DECIMAL(5,2),
    Manufacturing_Growth DECIMAL(5,2),
    Services_Growth DECIMAL(5,2),
    Exports_Change DECIMAL(5,2),
    Imports_Change DECIMAL(5,2),
    PRIMARY KEY (DisasterID, LocationID, Country)
)

Location (
    LocationID INT PRIMARY KEY,
    Name VARCHAR(255),
    Country VARCHAR(100),
    Region VARCHAR(100)
)

User (
    UserID INT PRIMARY KEY,
    Username VARCHAR(255),
    Email VARCHAR(255) UNIQUE,
    Role VARCHAR(50)
)

DirectDamage (
```

```
    DamageID INT PRIMARY KEY,
    DisasterID INT REFERENCES NaturalDisaster(DisasterID),
    LocationID INT REFERENCES Location(LocationID),
    PropertyDamage DECIMAL(12,2),
    InfrastructureDamage DECIMAL(12,2),
    Casualties INT
)

Region (
    RegionID INT PRIMARY KEY,
    Name VARCHAR(255),
    IncomeGroup VARCHAR(100)
)

GovernmentResponse (
    ResponseID INT PRIMARY KEY,
    DisasterID INT REFERENCES NaturalDisaster(DisasterID),
    LocationID INT REFERENCES Location(LocationID),
    AidAmount DECIMAL(12,2),
    PolicyChanges TEXT,
    RecoveryMeasures TEXT
)
```

Normalisation Justification

Natural Disaster:
Primary Key: {disaster_id}
Functional Dependencies:

- disaster_id → name, type, date

Checking for Transitive Dependencies:

- All attributes directly depend on disaster_id

MacroeconomicImpact:
Primary Key: {country, disaster_id, location_id}
Functional Dependencies:

- {country, disaster_id, location_id} → gdp_loss, gdp_growth_change, inflation_change, unemployment_change

Checking for Transitive Dependencies:

- All non-key attributes depend directly on {country, disaster_id, location_id}.
  MicroeconomicImpact:

Primary Key: {country, disaster_id, location_id}
Functional Dependencies:

- {country, disaster_id, location_id} → agriculture_growth, industry_growth, manufacturing_growth, services_growth, exports_change, imports_change

Checking for Transitive Dependencies:

- All non-key attributes depend directly on {country, disaster_id, location_id}.

Location:
Primary Key: {location_id}
Functional Dependencies:

- location_id → name, country, region
- Possible Issue: If country determines region, then location_id → country → region forms a transitive dependency.

Checking for Transitive Dependencies:

- If region is only dependent on country, then we should split this table into:
  - location(location_id, name, country)
  - region(country, region)
- Since region is already a separate table, transitive dependencies are already removed.

User:
Primary Key: {user_id}
Functional Dependencies:

- user_id → username, email, role
- email → user_id, username, role (since email is unique)

Checking for Transitive Dependencies:

- All attributes depend directly on user_id or email (which is also unique).
- No attribute is indirectly dependent on user_id through another attribute.

Region:

Primary Key: {region_id}

Functional Dependencies:

- region_id → name, income_group

Checking for Transitive Dependencies:

- All attributes depend directly on region_id.

Direct Damage:
Primary Key: {damage_id}
Functional Dependencies:

- damage_id → disaster_id, property_damage, infrastructure_damage, casualties, location_id

Checking for Transitive Dependencies:

- No attribute depends on another non-key attribute.

Government Response:

Primary Key: {response_id}

Functional Dependencies:

- response_id → disaster_id, location_id, aid_amount, policy_changes, recovery_measures

Checking for Transitive Dependencies:

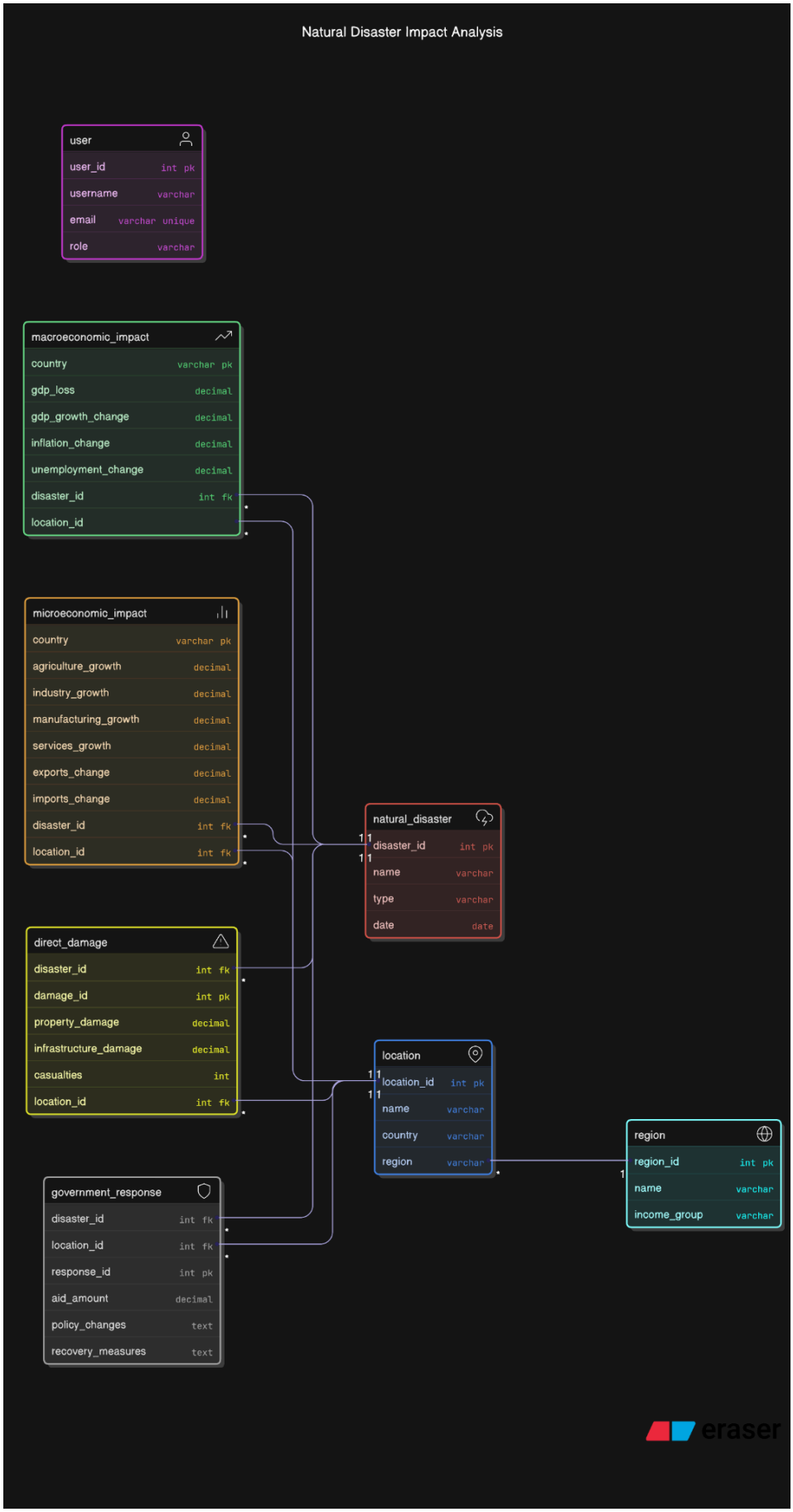
- No attribute depends on another non-key attribute.

Relationship Explanations & Cardinality

1. NaturalDisaster → MacroeconomicImpact (1-to-Many)
    - A single natural disaster can have multiple macroeconomic impacts (affecting multiple countries).
2. NaturalDisaster → MicroeconomicImpact (1-to-Many)
    - A disaster affects microeconomic indicators at different locations.
3. NaturalDisaster → DirectDamage (1-to-Many)
    - Each disaster results in multiple instances of direct damage at various locations.
4. NaturalDisaster → GovernmentResponse (1-to-Many)

- Each disaster can trigger multiple government responses, such as aid distribution and policy changes.

5. Location → Region (Many-to-One)
    - A location belongs to exactly one region, but a region contains multiple locations.
6. DirectDamage → Location (Many-to-One)
    - Each damage record is tied to a single location, but a location can experience multiple damage reports.
7. GovernmentResponse → Location (Many-to-One)
    - Each response is tied to a single location, but a location can have multiple responses.
8. User (Independent Entity)
    - The User entity is independent and does not have a direct relationship with other tables, but users can interact with the system.


Natural Disaster Impact Analysis
user
user_id int pk
username varchar
email varchar unique
role varchar
macroeconomic_impact
country varchar pk
gdp_loss decimal
gdp_growth_change decimal
inflation_change decimal
unemployment_change decimal
disaster_id int fk
location_id
microeconomic_impact
country varchar pk
agriculture_growth decimal
industry_growth decimal
manufacturing_growth decimal
services_growth decimal
exports_change decimal
imports_change decimal
disaster_id int fk
location_id int fk
natural_disaster
disaster_id int pk
name varchar
type varchar
date date
direct_damage
disaster_id int fk
damage_id int pk
property_damage decimal
infrastructure_damage decimal
casualties int
location_id int fk
location
location_id int pk
name varchar
country varchar
region varchar
region
region_id int pk
name varchar
income_group varchar
government_response
disaster_id int fk
location_id int fk
response_id int pk
aid_amount decimal
policy_changes text
recovery_measures text
eraser

Assumptions

NaturalDisaster

- Each disaster is a unique event identified by DisasterID
- Disasters have attributes Name, Type, and Date that differ event by event
- Disasters may have multiple impacts across differing countries and locations, so they cannot simply be an attribute of another entity

MacroeconomicImpact

- Gets the country-level impacts (GDP loss, inflation change, etc.) caused by a specific disaster
- A disaster could have macroeconomic impacts in multiple countries
- These impacts are linked to the disaster and it changes country by country

MicroeconomicImpact

- Gets location-level economic impacts from a specific disaster
- A disaster can impact many locations, and a location can be impacted by many disasters

Location

- Represents the cities/areas that the disaster occurs
- Each location is part of one Country and a larger Region
- Locations can experience more than one disaster at a time

Region:

- Grouped multiple countries by the general income group of the country

Direct Damage

- Gets the damage statistics based on property damage, infrastructure, and casualties
- This is grouped based on the DisasterId itself

User

- Only one user entity is allowed to handle roles/authentication
- Each user has unique email address (Email)
- Users can have roles (“Admin”, “Viewer”, etc.) but do not control disaster or economic data
- User attributes do not belong to other entities.